VARIATIONS ON THE ESCAPEMENT RETARD

CAMERA TECHNICIAN COURSE

Em?

VARIATIONS ON THE ESCAPEMENT RETARD

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THE ESCAPEMENT GEAR TRAIN

The escapement system is one of the most accurate self-contained means of controlling elapsed time over a comparatively long period. So we find the star wheel and pallet in watches and clocks, for accurate timing over extremely long periods, and in many photographic mechanisms for accurate timing over shorter periods.

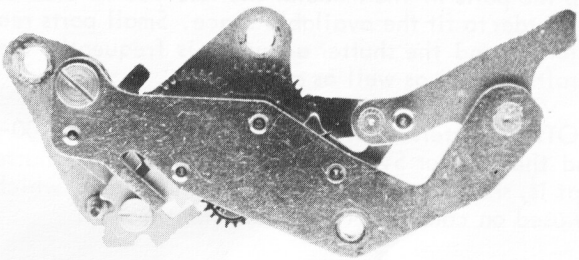


FIGURE 1 SPEEDS ESCAPEMENT

You have already seen three uses of the escapement system in different shutters -- as a self timer, the escapement may provide a relatively long delay; as a shutter speed control, the escapement provides several different running times; and as an M-sync delay, the escapement's running time is comparatively brief.

Lengthy gear trains, with small gears, are found in accessory delayed-action mechanisms -- that is, accessory units you attach to shutters which lack the internal self-timer feature. Normally, the accessory delayed-action mechanism is a spring-loaded "shutter tripper" which operates through a cable release. Because of the escapement design, the drive spring in the accessory delayed-action mechanism may unwind very slowly -- allowing as long as 20 seconds before actually releasing the shutter.

THE BUILT-IN SHUTTER

The escapements you have studied so far are cleverly designed to fit into the cramped quarters around the lens. A complex problem in the design of any shutter is proper use of available space. And in most of the shutters examined in previous lessons, the shutter mechanism fits into a housing which also serves as the lens mount.

The ingenuity of the designers has produced escapement gear trains and other parts that are curved to follow the shape of the housing. Even the main lever -- in larger models of the Compur, for example -- may be a ring which fits around the lens barrel to take best advantage of the existing space. Main levers in many other shutters follow this circular pattern, and usually provide for complete shutter operation with a very minimum amount of movement.

So the parts in the modular shutters you've studied must be small in order to fit the available space. Small parts require high precision -- and the shutter accuracy is frequently the result of fine craftsmanship as well as good design.

> NOTE: Shutters such as the Synchro-Compur 00-MXV and the Prontor SVS are examples of modular shutters -- that is, shutters made by a single manufacturer which may be used on cameras of many different makes.

In contrast to the modular shutter, the BUILT-IN SHUTTER is integral with the camera itself -- and, as such, is unique to the particular camera in which it is used. Built-in shutters may be extremely simple -- such as you studied in the Kodak Instamatic and Brownie Reflex cameras. Or, they may be quite complex -- such as the focal-plane shutters you will examine in future lessons.

The built-in shutter takes advantage of the large amount of space within the camera body. Since the parts are not restricted to the circular confines around the lens, they can be made comparatively large, rugged, and simple. Or, the parts may remain small and precise while the camera itself is scaled down to pocket-size proportions.

In this lesson, you will examine three variations of the built-in leaf-type shutter. And you'll see how the shutter blades may be located either behind the lens or between the lens elements -- even though the shutter blade driving and timing mechanisms are spread out behind the lens in the camera body.

The Argus C-3, Fig. 2, is a good example of a 35mm camera using a built-in behind-the-lens shutter. In the Argus C-3, almost a third of the volume of the camera body is used to house the shutter mechanism. The result of the Argus design is a shutter that is inexpensive to manufacture, easy to service, and quite dependable -- three factors which contributed to making the Argus C-3 one of the most popular 35mm cameras ever designed.

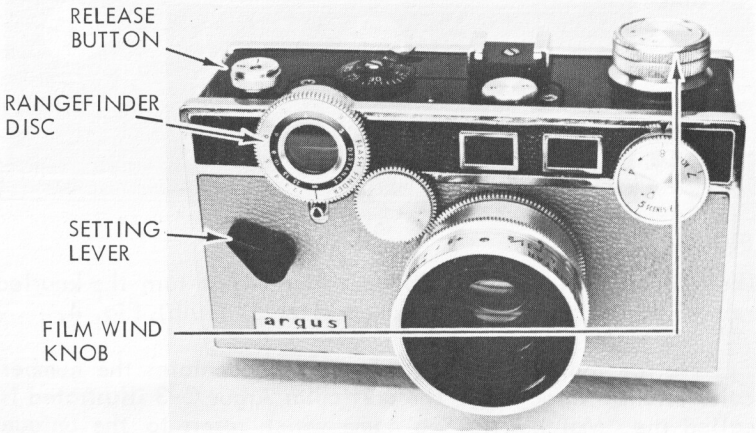


FIGURE 2 ARGUS C-3

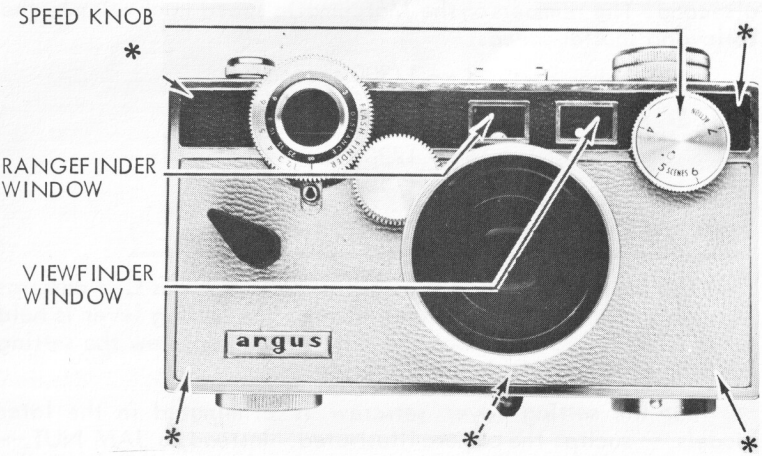


FIGURE 3 *DENOTE FRONT PLATE SCREW POSITIONS

The Argus C-3 has two controls in addition to the setting ever and the release button. One of these controls -- the SPEED KNOB--operates a cam to determine the amount of retard, Fig. 3.

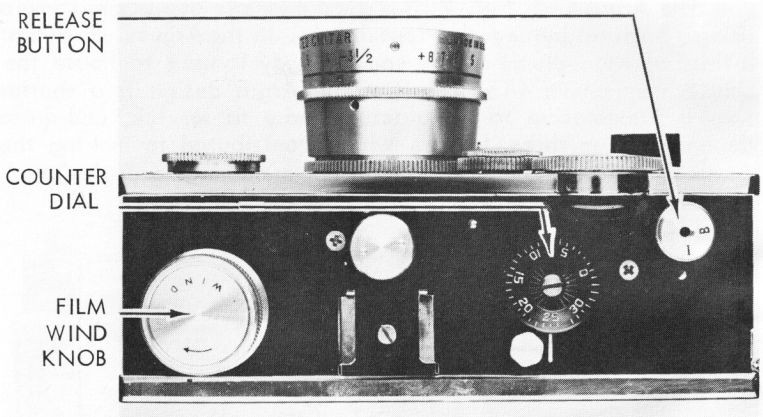


FIGURE 4

The other control permits "bulb" operation -- just turn the knurled release button from "I" (instantaneous) to "B" (bulb), Fig. 4.

Notice that the speed knob, Fig. 3, contains the number calibrations 4 through 8. The particular Argus C-3 illustrated is called the "Matchmatic," a name which refers to the unique method ot calibrating the shutter speeds and the f/stops. Other Argus C-3 models are calibrated in the conventional fractions of a second. The numbers on the Matchmatic speed knob refer to the following shutter speeds:

8 -- 1/300 second
7 -- 1/125 second
6 -- 1/60 second
5 -- 1/30 second
4 -- 1/10 second.

REMOVING THE FRONT PLATE IN THE ARGUS C-3

The front plate assemblies of the various Argus C-3 cameras vary only slightly. In the older models, the setting lever is held by a setscrew. Just loosen the setscrew and unscrew the setting lever in a counterclockwise direction.

But the setting lever setscrew is eliminated in the later models -- such as the camera illustrated. Instead, a JAM NUT -- located immediately under the setting lever, Fig. 5 -- holds the setting lever in place. The setting lever post (on the main lever, as you'll see in a moment) has a left-hand thread. So moving the setting lever counterclockwise to cock the shutter binds the jam nut and the setting lever more tightly against one another

FIGURE 5

Hold the newer-style setting lever stationary with your fingers and turn the jam nut counterclockwise with a thin-headed wrench -- you are now moving the jam nut away from the setting lever. Then, unscrew the setting lever from its post by turning it in a clockwise direction -- and, after removing the setting lever, turn off the jam nut in the same direction.

CAUTION: Do not remove the Argus C-3 speed knob during the front plate disassembly -- the speed knob remains in place on the front plate. In the Matchmatic, the speed knob retaining screw is covered by the cemented calibration plate. But in other models, the screw is visible -- and there's always a temptation to remove an exposed screw. The speed cam -- which controls the movement of the retard section -- is attached to the back side of the speed knob. So by removing the screw, you lose the timing between the speed knob and the speed cam. You can, however, see the proper speed cam timing in figures 7 and 8.

Five or six screws (the number depending on the model) retain the front plate to the camera body. These screws are underneath the leatherette covering the front plate, as indicated by the arrows in figure 3. So carefully lift the leatherette at the four corners of the front plate with your bench knife -- try to avoid tearing or sharply creasing the leatherette.

Another screw is located at the bottom center of the front plate -- as indicated by the dashed arrow in figure 3. And, in some models, there is a sixth screw adjacent to the rangefinder window. You can reach the lower screw without completely removing the leatherette -- either lift the bottom of the leatherette or cut the leatherette as indicated by the dashed arrow, Fig. 3. Make your cut very carefully with the sharp point of your bench knife -- when you later recement the leatherette, the cut will be almost undetectable.

If the sixth retaining screw is used, you can cut the leatherette by the rangefinder window, Fig. 6. Remove all of the flat-headed screws which hold the front plate. Then, carefully lift off the front plate -- be careful you don't drop out the CAM FOLLOWER which remains with the front plate, Fig. 7.

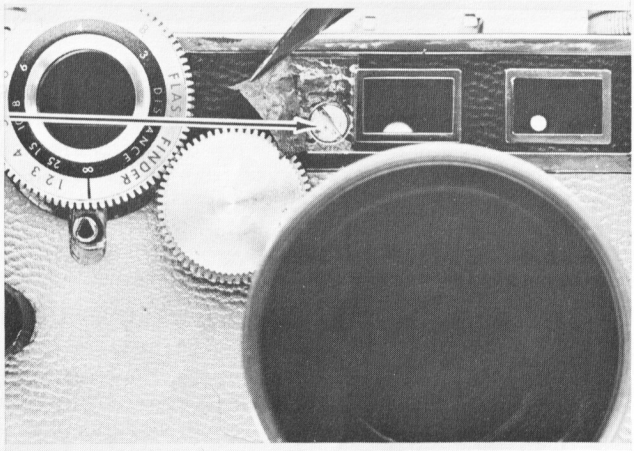


FIGURE 6

CAUTION: The front lens for the eyepiece may be loose once you've removed the front plate. If so, lift out the lens to prevent loss or damage -- the lens sits in the round cavity to the right of the rangefinder assembly, Fig. 10.

Figure 7 shows the inside of the front plate -- here, you can see the speed cam and the cam follower. The pin on the cam follower fits into the hole in the BELL CRANK (in the lower right-hand corner of the camera body, Fig. 9). The bell crank is part of the linkage between the speed cam and the speeds escapement, also pointed out in figure 9.

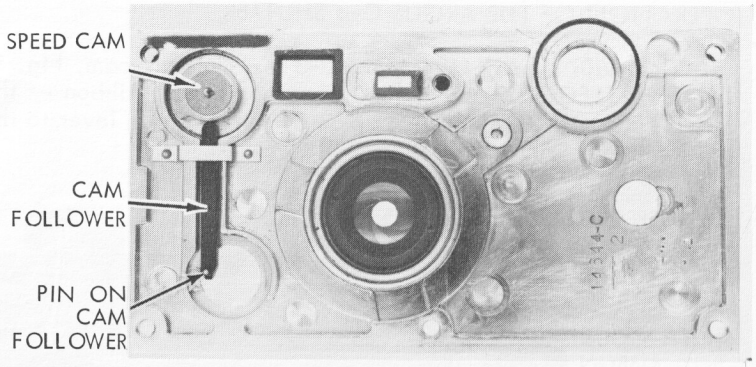


FIGURE 7

SHUTTER SET TO 1/300 SECOND ("8" ON MATCHMATIC)

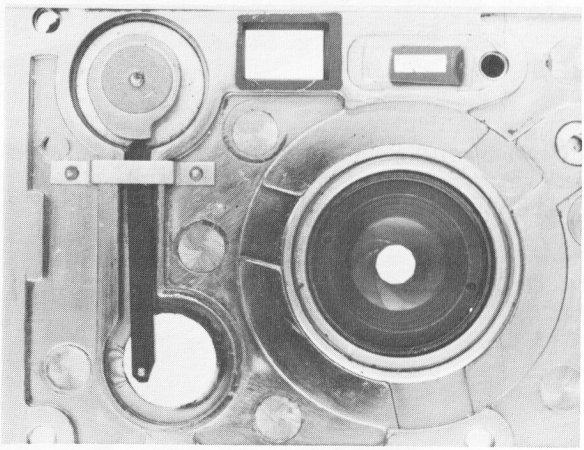


FIGURE 8

SHUTTER SET TO 1/10 SECOND ("4" ON MATCHMATIC)

You'll notice that the cam follower is at its highest position when the camera is set to the fastest shutter speed (1/300 second), Fig. 7. And the cam follower is at its lowest position when the shutter is set to the slowest shutter speed (1/10 second), Fig. 8.

OPERATION OF THE ARGUS C-3 SHUTTER

The main lever in the Argus C-3 is a multiple cam, Fig. 9. The SHUTTLECOCK and a long phosphor bronze ribbon -- the SHUTTLECOCK RIBBON -- connect the main lever to the tension-type mainspring.

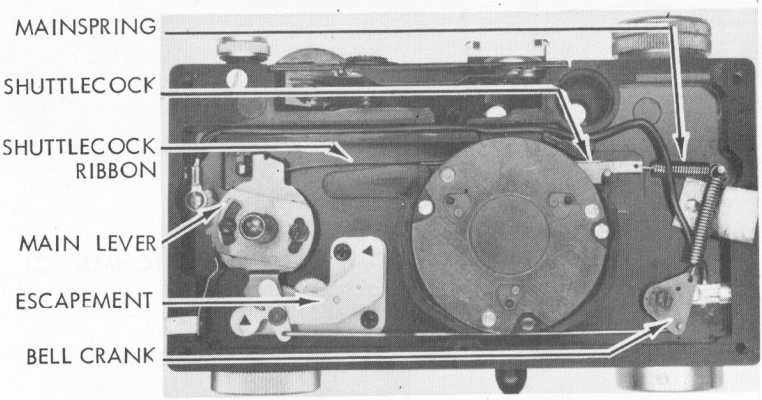


FIGURE 9

To cock the shutter, rotate the main lever in a counterclockwise direction with your finger -- as shown in figure 10. The main lever is then latched in the cocked position by the lower end of the RELEASE PLUNGER, Fig. 11.

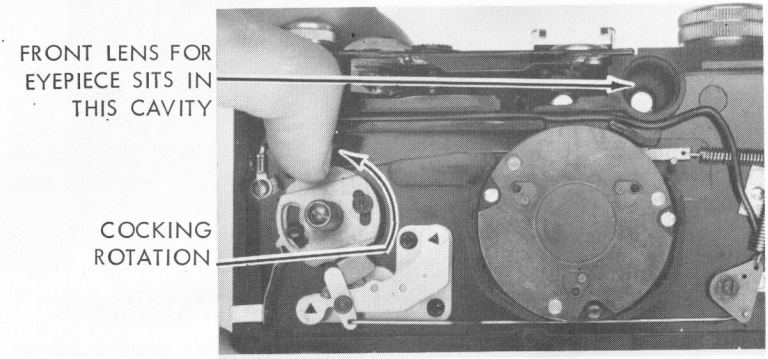


FIGURE 10

Depressing the release button pushes the release plunger down to free the main lever. Now, the mainspring pulls the shuttlecock from left to right, causing the main lever to rotate in a clockwise

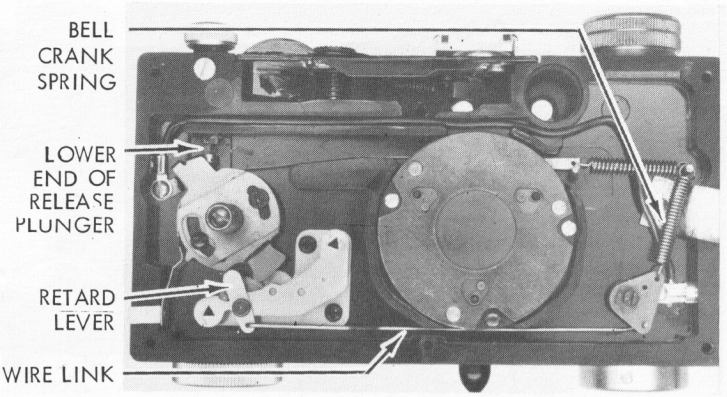


FIGURE 11 SHUTTER COCKED

direction. The shuttlecock assembly, during its release travel, contacts a lug on the blade operating ring to open the shutter blades -- you'll be able to see the action of the shuttlecock more clearly after we remove the shutter blade assembly. A spring on the blade operating ring, not yet visible, then closes the shutter blades.

Since you've removed the front plate -- and, along with it, the speed cam and the cam follower -- the shutter now delivers the fastest speed (1/300 second). The reason is that the bell crank spring, Fig. 11, holds the bell crank all the way in the counterclockwise direction.

Setting slower shutter speeds pushes the bell crank in a clockwise direction -- the speed cam pushes the cam follower down, and the cam follower in turn rotates the bell crank. Notice in figure 11 that a long WIRE LINK connects the bell crank to the RETARD LEVER in the speeds escapement.

In its present position -- 1/300 second -- the retard lever holds the first gear segment (in the speeds escapement) away from the lobe at the bottom of the main lever. But as you select slower speeds, the bell crank pulls the retard lever away from the first gear segment. The first gear segment then turns clockwise, under its own spring tension, as simulated in figure 12 -- now, the pin (on the first gear segment) is in the position to intercept the lobe (on the main lever) during the release cycle.

So the position of the bell crank determines the position of the retard lever -- and the retard lever decides how far the

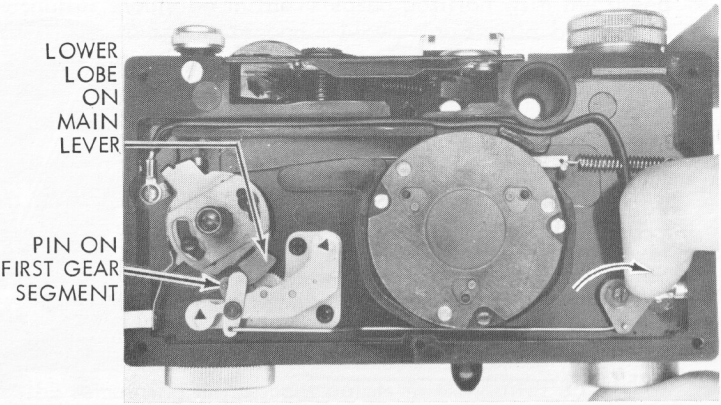


FIGURE 12

first gear segment rotates in a clockwise direction. The farther the first gear segment moves clockwise, the longer it remains in contact with the main lever lobe during the release cycle -- and the slower the resulting shutter speed.

The bell crank pivots on an eccentric bearing which provides an adjustment point for the shutter speeds. You'll adjust the shutter speeds after replacing the front plate -- a hole through the front plate allows you to reach the eccentric bearing, as you'll see a little later.

You can see that the Argus C-3 retard system is quite unlike anything examined in previous systems. But the most unusual part of the whole design is the time at which the retard is introduced. In other shutters we've discussed, the blades open fully before the speeds escapement slows down the main lever -- the escapement then holds the blades fully open for the required length of time. Yet in the Argus C-3, the main lever strikes the first gear segment just as the blades start to open. So the retard is introduced during the blade-opening time -- the slower the shutter speed, the more slowly the blades open.

The position of the pin on the first gear segment at the slowest shutter speed is critical -- careful observation now will help you in adjusting the escapement during reassembly. That is, the speeds escapement has a sliding adjustment -- after loosening the two screws shown in figure 13, you can slide the complete escapement to adjust its position. Referring to figure 13, here's the timing you should note:

With the first gear segment in the slowest-speed position and the main lever in the cocked position, the lobe on the main lever should contact the pin on the first gear segment -- but, at the same time, complete rotation of the main lever must be possible without interference from the first gear segment.

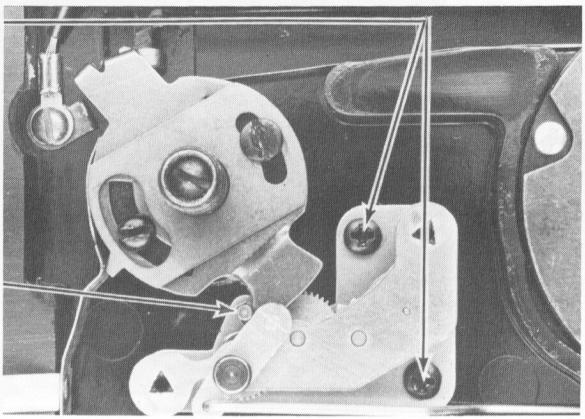


FIGURE 13

To obtain "bulb" action, rotate the release button until its "B" calibration aligns with the index dot on the camera body. Turning the release button to "B" rotates the release plunger to the position shown in figure 14. Now, when you release the shutter, the blades open to the full-open position -- but the flatted

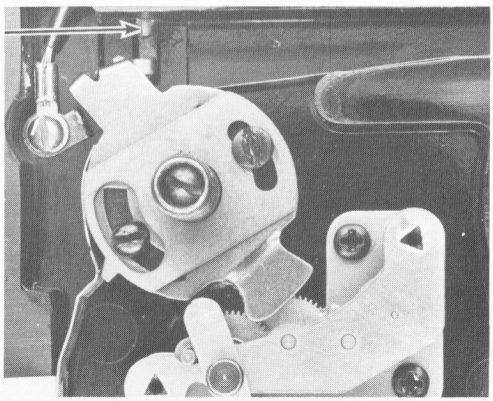


FIGURE 14 SHUTTER COCKED, SET TO "BULB"

end of the release plunger catches the upper lug on the main lever, Fig. 15. Consequently, the main lever is arrested before the shuttlecock has moved far enough for the shutter blades to close. When you let up on the release button, the release plunger frees the main lever -- so the main lever completes its rotation and the shuttlecock moves past the lug on the blade operating ring.

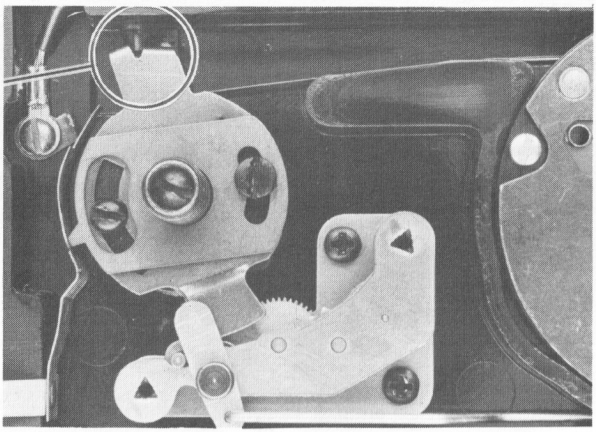


FIGURE 15 SHUTTER HELD OPEN ON "BULB"

DISASSEMBLY OF THE ARGUS C-3 SHUTTER

Remove the shutter blade assembly by taking out the three screws shown in figure 16. Now, on the back of the assembly, you can see the spring-loaded blade operating ring lug that is engaged by the shuttlecock assembly to open the blades, Fig. 17.

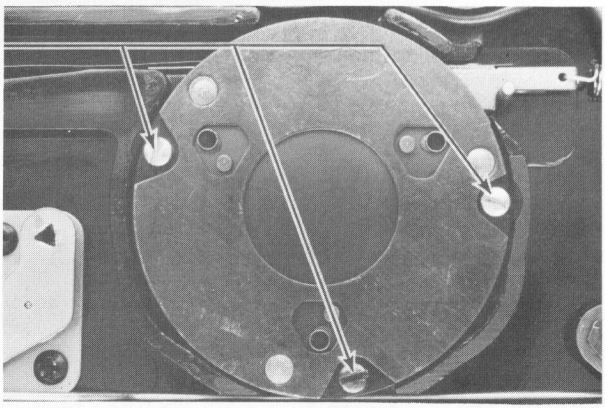


FIGURE 16

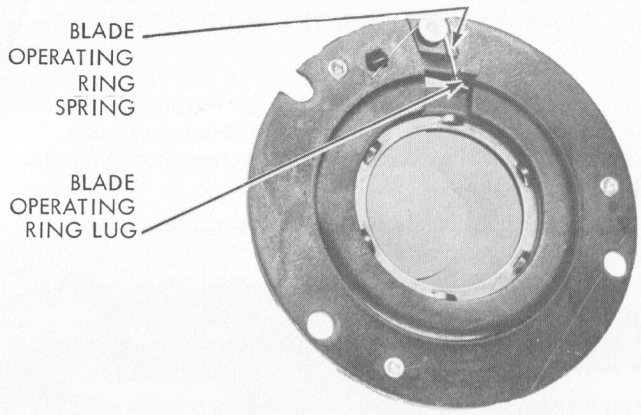


FIGURE 17

The shuttlecock is also clearly visible at this time, Fig. 18. During the cocking cycle, the pivoting action of the spring-loaded SHUTTLECOCK LATCH, Fig. 18, allows the latch to bypass the blade operating ring lug--but on the release cycle, the shuttlecock latch engages the lug and drives the blades to the open position.

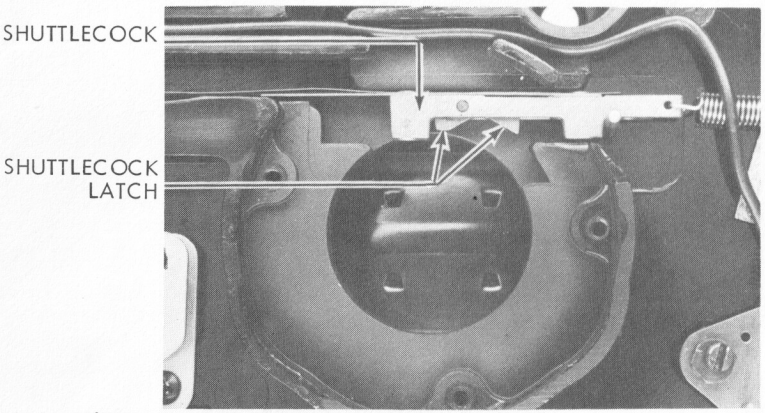
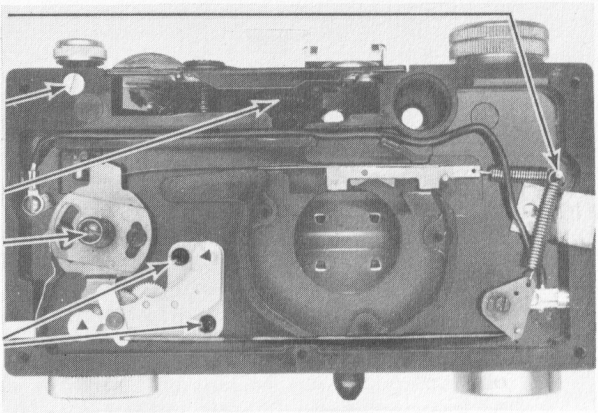


FIGURE 18

Now, disconnect the wire link from the retard lever. Remove the two screws shown in figure 19 and lift out the entire speeds escapement.

Disconnect the two tension springs -- the bell crank spring and the mainspring -- from the post on the camera body, Fig. 19. Remove the main lever by taking out the screw through its threaded post, Fig. 19.



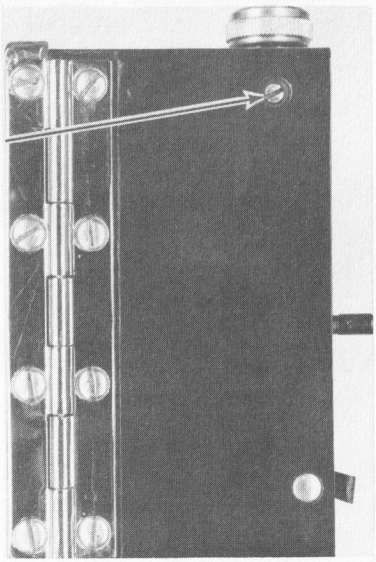


FIGURE 20

To remove the release plunger, first take out the setscrew at the end of the camera body, Fig. 20 -- but be careful: a spring and a ball detent remain inside the cavity. The ball detent acts on the rotating part of the release plunger assembly, holding it in either the "I" or the "B" position; and the setscrew you just removed determines the amount of spring tension on the detent. You can now remove the spring and the ball detent from the setscrew cavity.

Remove the brass pin screw at the front of the camera, Fig. 19, and lift out the release plunger. The release plunger is a complete unit which does not require further disassembly.

As we mentioned earlier, the bell crank pivots on an eccentric bearing. The eccentric bearing is pointed out in figure 21; the screw, also seen in figure 21, both holds the adjustment of the eccentric bearing and retains the bell crank. To take out the bell crank, remove the screw and the eccentric bearing. Now, lift out the bell crank and the wire link -- you'll have to adjust the eccentric bearing on reassembly to time the shutter speeds.

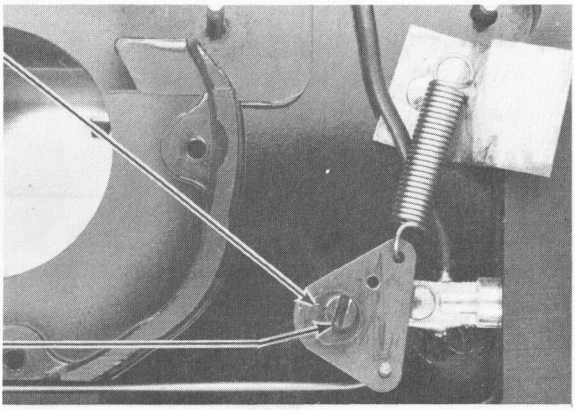


FIGURE 21

You will rarely have to disassemble the camera any further than we have just done -- at least to service the shutter. The disassembly and adjustment of the rangefinder, pointed out in figure 19, is covered in a later lesson -- avoid disturbing the rangefinder at this time.

REASSEMBLY OF THE ARGUS C-3 SHUTTER

Replace the bell crank and the wire link as one assembly. Then, seat the eccentric bearing and replace the retaining screw

-- make sure the eccentric shoulder on the bearing passes through the hole in the bell crank. While tightening the screw, check to assure that the bell crank pivots freely.

Insert the release plunger assembly through its hole at the top of the camera -- the elongated slot in the release plunger (which receives the brass pin screw) must be to the front of the camera. Then, replace the brass pin screw from the front of the camera.

The release plunger should now rotate freely between the "B" and "I" positions -- remember, the ball detent and spring hold the release plunger at either setting. Place first the ball detent, and then the spring, into the cavity at the end of the camera body. Then, tighten the setscrew until you feel the two solid "click-stop" positions of the release plunger.

Before replacing the main lever and shuttlecock assembly, examine the joint between the shuttlecock ribbon and the main lever, Fig. 22. You can see that the shuttlecock ribbon is soldered within a slot in the body of the main lever. Replacing a broken shuttlecock ribbon is one of your more common repairs in the Argus C-3.

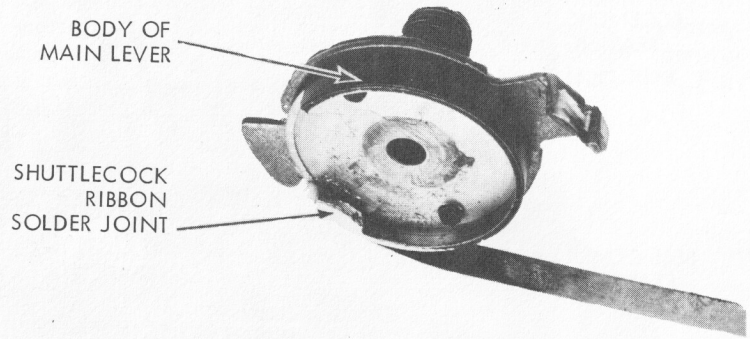


FIGURE 22 UNDERSIDE OF MAIN LEVER

Handle the shuttlecock ribbon very carefully as you lower the main lever into position. Accidentally placing a kink in the shuttlecock ribbon could cause the metal to fail during the shutter operation. When the assembly is fully seated, replace the main lever retaining screw and hook the end of the mainspring over its post. Test the movement of the main lever by cocking and releasing the shutter several times.

Hook the end of the bell crank spring over the post on the camera body. Now, cock the shutter and seat the speeds escape-

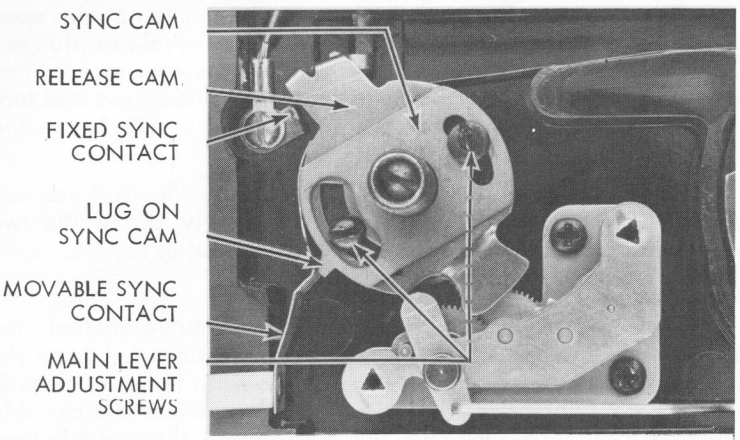
ment in position. Make sure that both the main lever lobe and the retard lever (with its hole end down) are to the right of the stud on the first gear segment. Then, replace the two screws holding the speeds escapement.

Before tightening the two screws, adjust the speeds escapement to the position shown in figure 13. Then, tighten the two screws to hold the adjustment. Check your adjustment by cocking and releasing the shutter several times -- the stud on the first gear segment must not slip past the main lever lobe as you cock the shutter. When you're sure the retard position is correct, hook the end of the wire link to the hole in the retard lever.

As you seat the shutter blade assembly, make sure the stud on the blade operating ring is toward the top of the camera. Then, replace the three retaining screws -- the long screw goes to the bottom of the shutter blade assembly.

ADJUSTMENTS ON THE ARGUS C-3 MAIN LEVER

We mentioned earlier that the main lever is a multiple cam. Actually, the main lever is in three separate parts -- and the relationships of these parts to one another may require adjustment on reassembly. The two screws provided at the front of the main lever, Fig. 23, hold the sections of the main lever together as one piece -- but by loosening the screws, you can reposition each part of the main lever.



The three sections of the main lever are: the main BODY which secures the shuttlecock ribbon, Fig. 22; the RELEASE CAM which engages the release plunger and the pin on the first gear segment, Fig. 23; and the SYNC CAM which closes the internal sync contacts, Fig. 23. To adjust the release cam, you must loosen both of the screws shown in figure 23. But to adjust the sync cam, just loosen the one screw indicated by the dashed arrow.

First, let's check the adjustment of the release cam. Cock the shutter and set the release plunger to "bulb." Now, release the shutter and hold the release button depressed -- the shutter blades should remain fully open. But if the release cam is out of adjustment, the shutter blades either will fail to remain open on "bulb," or will open only part way.

Say, for example, that the shutter blades remain partially open on "bulb" -- this means that the main lever is blocked by the release plunger before rotating far enough to allow full blade opening.

The correction is to continue holding the shutter open on "bulb" and loosen the two screws, Fig. 23 -- loosening the screws allows the body of the main lever to turn separately from the release cam. Now, while the release cam remains held by the release plunger, allow the body of the main lever to rotate slowly (clockwise) until the blades are fully open -- then, retighten the screws. As the body of the main lever turns clockwise, the shuttlecock ribbon moves farther to the right -- and that allows the shuttlecock to open the blades the additional amount.

The other symptom of maladjustment is that the blades open and close before the release cam is arrested by the release plunger. Consequently, the shutter delivers an instantaneous speed when set to "bulb." The correction is to loosen the two screws and turn the body of the main lever counterclockwise in relation to the release cam.

Once you've adjusted the release cam at "bulb," you can check the timing of the sync cam. Since only one of the two screws in figure 23 holds the sync cam, adjusting the flash sync doesn't disturb the release cam adjustment.

Compared to some of the other shutters you've studied, the operation of the Argus C-3 flash sync is quite simple. Locate the lug on the sync cam in figure 23 -- as the main lever revolves in the release (clockwise) direction, this lug strikes the movable sync contact. The sync cam lug then pushes the movable sync contact against the fixed sync contact to fire the flash.

By loosening the sync cam screw, Fig. 23, you can move the sync cam to change the time at which the flash is fired. Here, you have a wide adjustment range -- by just turning the sync cam, you can change the sync delay all the way from "F" sync to "X" sync.

Most Argus C-3's are set for "F" sync -- that is, the contacts close to fire the flash just before the shutter blades start to open. The actual delay is then the time it takes for the blades to reach the full-open position. But if your customer wants you to convert his Argus C-3 to "X" sync for electronic flash, all you have to do is turn the sync cam until the contacts close when the blades reach the full-open position.

REPLACING THE FRONT PLATE AND ADJUSTING THE SHUTTER SPEEDS IN THE ARGUS C-3

When either the speeds escapement or the bell crank has been removed, you must readjust the shutter speeds. Strip back the leatherette from the lower right-hand corner of the front plate to reveal the inspection disc, Fig. 24. By removing the inspection disc, you can reach the eccentric bearing on the bell crank.

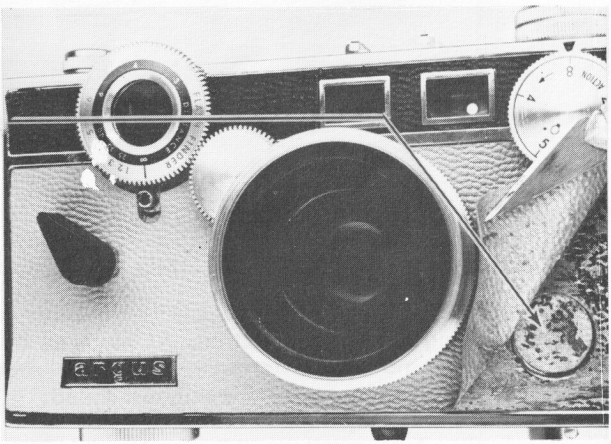


FIGURE 24

Set the speed cam at the highest speed (for ease of alignment) and fit the cam follower in position, Fig. 7. Now, seat the front plate on the camera body -- you can work through the inspection hole in the front plate to fit the cam follower pin into the bell crank hole. Then, replace the screws holding the front plate --

the long screw, if there is one, goes beside the rangefinder window.

Depress the release button to make sure the shutter is in the released position. Now, replace the setting lever -- remember, the setscrew-type has a right-hand thread, while the jam-nut type has a left-hand thread. If you're installing the setscrew-type, turn the setting lever clockwise as far as it will go. Then, back off the setting lever until it points to 10:30 o'clock, Fig. 25, and tighten the setscrew.

But if you're installing the jam-nut type, first screw on the jam nut in a counterclockwise direction as far as it will go. Then, turn the setting lever all the way down to the jam nut. Back off the setting lever to 10:30 o'clock, Fig. 25. While holding the setting lever in position, use a thin-headed wrench to turn the jam nut clockwise -- until the jam nut is tight against the underside of the setting lever.

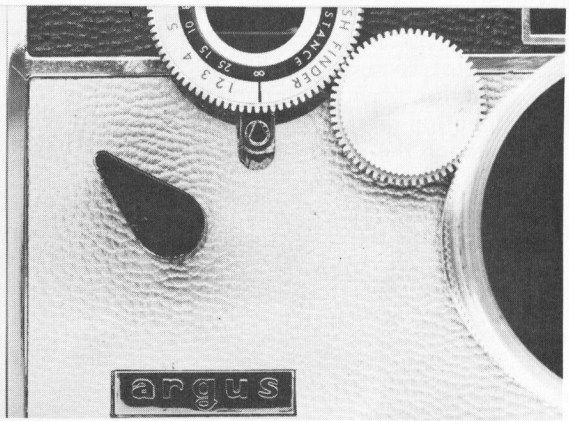


FIGURE 25 TIMING OF SETTING LEVER

You can now make a fairly accurate adjustment of the speeds by just listening to the retard action. At the fastest shutter speed, there should be no retard action -- and there should be just a trace of retard at the next-to-the-highest speed.

Cock the shutter and set the speed knob to the fastest speed (1/300 second). Now, while restraining the setting lever to slow down the main lever's rotation, push the release button. As you allow the main lever to run slowly through its cycle, listen for the sound of the retard.

If you can detect retard engagement at 1/300 second, you must adjust the eccentric bearing. Working through the inspection

hole in the front plate, loosen the bell crank screw and turn the eccentric bearing. Set the eccentric bearing so you can hear no retard action at the fastest speed, and just a trace of retard at the next-to-the-highest speed.

But if you can't get enough adjustment out of the eccentric bearing, you may have to bend the wire link to change its effective length. Shortening the wire link provides less retard, and lengthening the wire link provides more retard. Bending the wire link is a rough adjustment for the shutter speeds -- you can then make fine adjustments by turning the bell crank lever eccentric.

When you're sure everything is working properly, recement the leatherette. Pliobond, a rubber-base cement, works well for this purpose. Apply a thin film of Pliobond to both surfaces -- the camera body and the back of the leatherette -- and allow the cement to dry until it is tacky. Be sure your cement is applied evenly -- "lumps" of excessive cement can damage certain types of leatherette. Then, press the leatherette to the camera body.

THE ARGUS C-4 SHUTTER

A more refined camera using the built-in behind-the-lens shutter is the Argus C-4, Fig. 26. But the shutter in the Argus C-4 bears little other resemblance to the C-3 design you just studied.

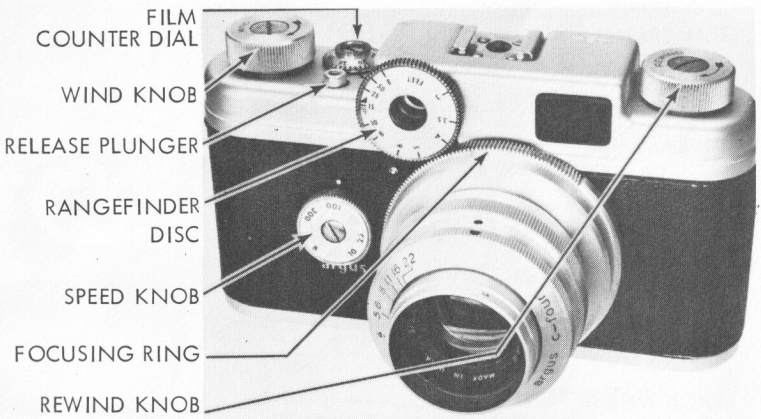


FIGURE 26 ARGUS C-4

Three other Argus cameras use the same shutter design as we find in the C-4. The Argus 21 just lacks the built-in rangefinder. The Argus C-44 adds the feature of interchangeable lenses; and the Argus C-44R, the top of the line, replaces the wind knob with the more-convenient rapid-wind lever.

REMOVING THE ARGUS C-4 SHUTTER ASSEMBLY

Reaching the built-in Argus C-4 shutter involves a very straightforward disassembly. So we'll just outline the procedure here. First, remove the screw holding the wind knob. Lift off the wind knob and take out the two screws holding the wind knob seat (underneath the wind knob). You can now lift off the wind knob seat and the brass wind shaft with its compression spring.

Take off the rewind knob by removing its center screw. Now take out the two screws holding the spacer around the rewind shaft.

One screw holds the film counter dial. Remove the screw and lift off the dial -- the washer and compression spring, sitting underneath the film counter dial (with the washer on top of the spring) can then be removed.

Lift the top cover plate high enough to see where the sync wires are soldered, Fig. 27. Note the positions of the wires by their color codes -- then, unsolder the three wires and remove the top cover plate. Lift off the loose spacer which sits around the rewind shaft, Fig. 27.

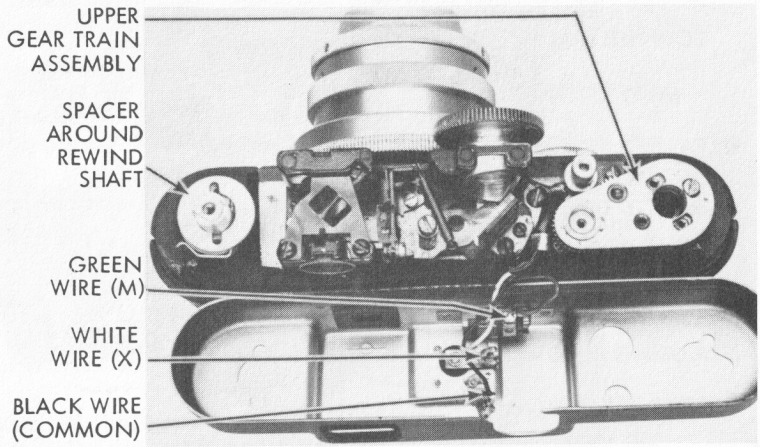


FIGURE 27

Only one screw still holds the upper gear train assembly, Fig. 27, at the wind-knob end of the camera body. The two screws holding the wind lever seat (which you removed earlier) also thread through the upper gear train assembly. By just loosening the remaining screw, you can slide the complete upper gear train assembly in position -- this is a depth-of-engagement adjustment which influences the "feel" of the wind stroke. In other words, if the camera winds too hard, the depth of engagement may be too deep.

Make a note of (or scribe) the positioning of the upper gear train assembly -- then, take out the one remaining screw and lift off the complete assembly. The idler gear, which is now loose, sits collar-up over the post on the upper gear train mechanism plate.

NOTE: Turning the wind knob to cock the shutter rotates the sprocket through the upper gear train. So, with the wind knob removed, you can cock the shutter just by turning the sprocket. You'll see how the sprocket cocks the shutter a little later in the disassembly.

Turn the base lock on the bottom of the camera in the "open" direction and remove the camera back. Next, remove the pin screw shown in figure 28 -- this screw holds the lens assembly to the FOCUSING RING. After removing the pin screw, simply unscrew the lens assembly in a counterclockwise direction.

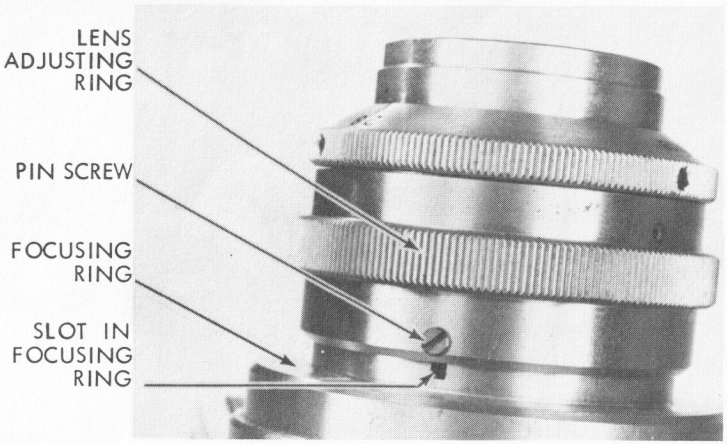


FIGURE 28

NOTE: On reassembly, you'll have to adjust the lens for proper focus. Although lens focusing procedures are covered later in your course, we'll describe the procedure for the C-4 in this text.

The pin screw you just removed keys into a slot in the focusing ring. And the focusing ring gears to the RANGEFINDER DISC, Fig. 26. For reassembly reference on the timing between the focusing ring and the rangefinder disc, set the rangefinder disc to the infinity position. Notice that the last tooth at the left-hand end of the focusing ring geared rack now engages the range-finder disc -- that is, when the infinity calibration on the range-finder disc aligns with the index dot on the camera front plate.

Remove the retaining ring that holds the focusing ring in place. Now, lift off the focusing ring.

You must peel back the front leatherette on each side of the lens mount to reach the four screws holding the camera front plate assembly. You'll find, however, that it's often difficult to remove the leatherette without damage -- even though you're very careful. So if you do much Argus C-4 work, you might find it desirable to keep some new leatherette in stock.

After removing the front leatherette, take out the four front plate retaining screws. Then, lift out the complete front plate/-shutter assembly as one unit. Figure 29 shows the front plate/shutter assembly removed from the camera body.

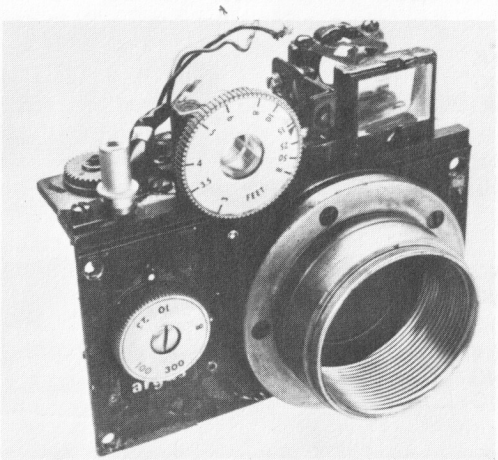


FIGURE 29 FRONT PLATE/SHUTTER ASSEMBLY

SHUTTER OPERATION IN THE ARGUS C-4

At this stage of disassembly, you can cock and release the shutter to examine the operations of the various parts. Cock the shutter by turning the sprocket with your finger -- turn the sprocket in the direction shown in figure 30 until it stops. Release the shutter by pushing down the release plunger, Fig. 30.

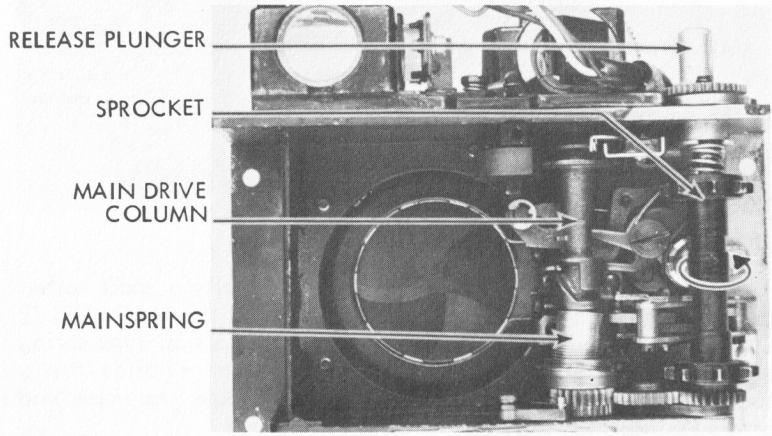


FIGURE 30 BACK OF FRONT PLATE/SHUTTER ASSEMBLY

Now, try turning the sprocket in the direction opposite to the curved arrow in figure 30 -- notice that the SLIDE PLATE underneath the sprocket swings toward the front of the camera, Fig. 31. As it moves, the slide plate carries the idler gear out of engagement with the MAIN WIND GEAR, Fig. 31. So the sprocket turns freely in a clockwise direction (as seen from the top of the camera) while you are rewinding the film into the 35mm cassette. To rewind the film, just lift up on the wind knob (to disengage the upper gear train) and turn the rewind knob in the direction of its arrow, Fig. 26.

You'll learn more about film wind and film metering mechanisms in a later lesson. For now, remember that the sprocket turns in one direction -- indicated by the curved arrow in figure 30 -- to advance the film to the next frame and to cock the shutter. But the sprocket must be able to turn freely in the opposite direction as you rewind the film into the cassette (prior to removing the film for processing).

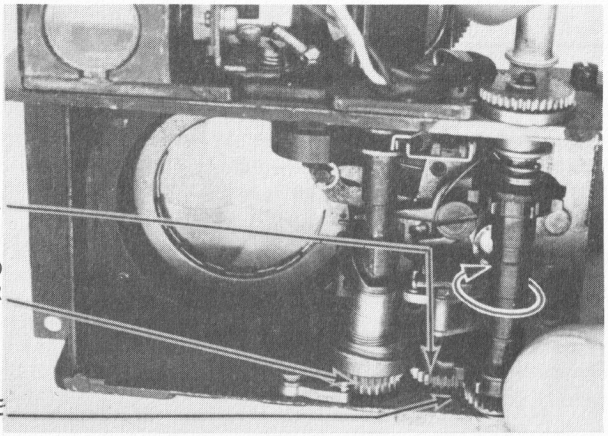


FIGURE 31 REWIND CYCLE

The main lever in the Argus C-4 is actually a shaft rather than a lever. So we refer to the main lever as the MAIN DRIVE COLUMN in figure 30. The mainspring is the torsion-type spring sitting at the bottom of the main drive column -- notice that a lug at the bottom of the main drive column hooks the upper end of the mainspring, Fig. 32.

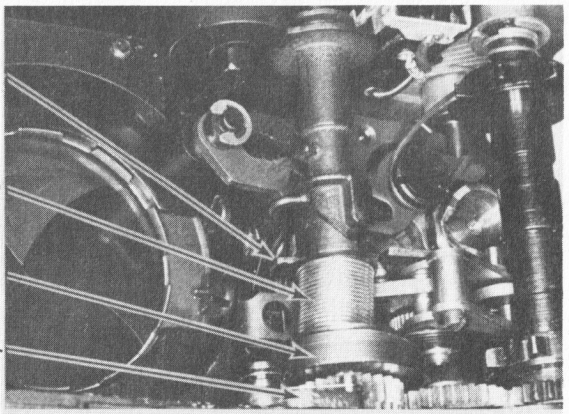


FIGURE 32

The other (lower) end of the mainspring hooks within a notch in the WIND CAM, Fig. 32. And the wind cam is attached to the main wind gear, the large brass gear we examined earlier. The spring-loaded pawl mounted to the bottom of the shutter assembly engages the teeth of the main wind gear -- this pawl assures that the main wind gear can only turn in one direction.

Now, with the shutter in the released position, notice that the main drive column is latched by the RELEASED-POSITION LATCH, Fig. 33. The released-position latch is the part that prevents the mainspring from turning the main drive column in the release rotation (the release rotation is indicated by the curved arrow in figure 33). Even though the shutter isn't cocked, there is a certain amount of tension on the mainspring -- this is the INITIAL TENSION. If you remove the mainspring, as we'll later describe, you must replace the correct amount of initial tension on reassembly.

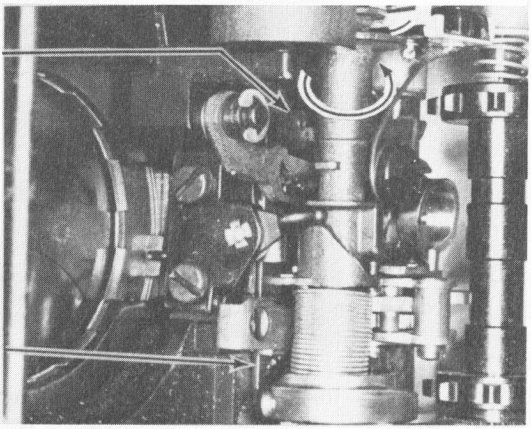


FIGURE 33 RELEASED POSITION

The position of the main drive column when the shutter is cocked is only slightly different from that shown in figure 33. If you'll slowly rotate the sprocket in the cocking direction, Fig. 30, you can see the main drive column jump slightly in the direction of the curved arrow in figure 33 -- this slight movement indicates that the main drive column is now in its "ready" position.

Let's follow through the cocking cycle to see how the main drive column moves from its released position (held by the released-position latch) to its "ready" position. As you turn the sprocket in the film-advance direction, the gear on the bottom of the sprocket turns the idler gear. The idler gear then turns the main wind gear to rotate the wind cam and tension the mainspring.

During the cocking rotation, the cam surface on the wind cam raises the TRANSFER SHAFT, Fig. 33 -- that is, pushes the transfer shaft toward the top of the camera. The upper end of the transfer shaft then pushes the released-position latch up to disengage the main drive column.

The main drive column now starts to turn in its release rotation. But the upward movement of the transfer shaft also allows the INNER RELEASE LEVER to move up. Notice in figure 34 that a pin on the transfer shaft rides within a cutout in the inner release lever -- so the transfer shaft controls the position of the spring-loaded inner release lever.

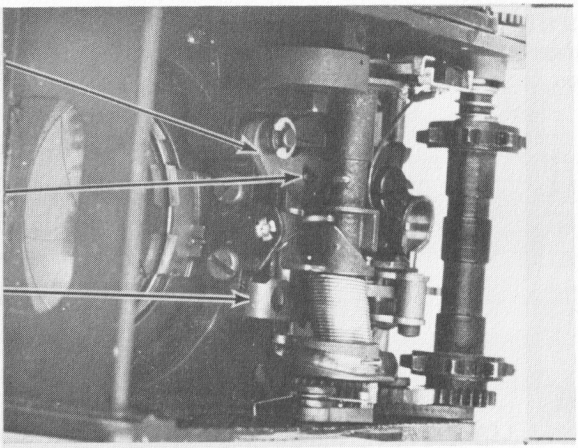


FIGURE 34 "READY" POSITION

Now, the inner release lever swings into position to intercept the release rotation of the main drive column. The main drive column can turn only a slight distance before it is latched by the inner release lever, Fig. 34. And the spring-loaded released-position latch is then held against its tension by the lug on the main drive column (the same lug that the released-position latch formerly engaged and is now engaged by the inner release lever).

You can continue turning the sprocket in the film-advance direction until the lower end of the transfer shaft blocks the lug on the wind cam -- when the transfer shaft is pushed up by the wind cam, it comes into position to block the wind cam at the end of the cocking cycle. The transfer shaft is held in its "up" position by the tension on the spring clip, Fig. 34.

The shutter is now in the fully-cocked position: the wind cam is blocked by the transfer shaft (after the sprocket has metered off the correct amount of film) and the main drive column is latched by the inner release lever (rather than by the released-position latch).

When you release the shutter, the release plunger pushes the inner release lever out of engagement with the main drive column.

Now, the main drive column spins in its release rotation. As soon as the latching lug on the main drive column passes from underneath the released-position latch, the spring-loaded released-position latch pushes the transfer shaft back down -- the lower end of the transfer shaft then falls below the lug on the wind cam, freeing the wind cam prior to the next cocking cycle.

Now, the released-position latch is in position to catch the latching lug on the main drive column. So the main drive column spins in its release rotation until the latching lug once again strikes the released-position latch, Fig. 33.

As the main drive column turns in the release rotation, it drives the blade operating ring to open and close the shutter blades. The link between the main drive column and the blade operating ring is the LEAF LEVER, Fig. 35 (called the "TOGGLE PLATE" by Argus). Notice that one end of the leaf lever rides within the cam groove in the main drive column -- the other end of the leaf lever engages the blade operating ring.

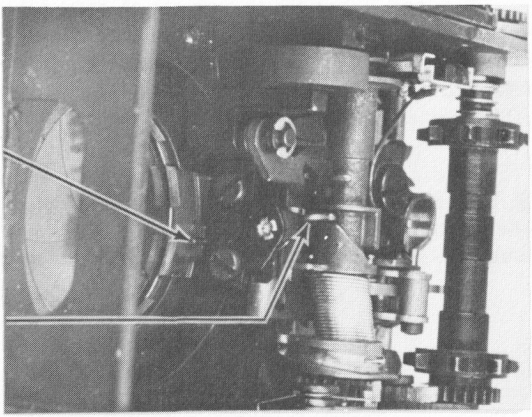


FIGURE 35

As the main drive column turns, it drives the leaf lever first up (to open the blades), and then down (to close the blades). But the main drive column turns only in one direction -- counterclockwise, as seen from the top of the camera.

Different instantaneous speeds are obtained by retarding the main drive column's rotation when the blades reach the full-open position. Locate the speeds escapement which is riveted to the camera body, Fig. 36. Once the main drive column has turned far enough to open the blades, its RETARD DRIVING LUG (the same lug which hooks the mainspring) strikes the pin on the first

gear segment. The speeds escapement then slows down the rotation of the main drive column to hold the blades open.

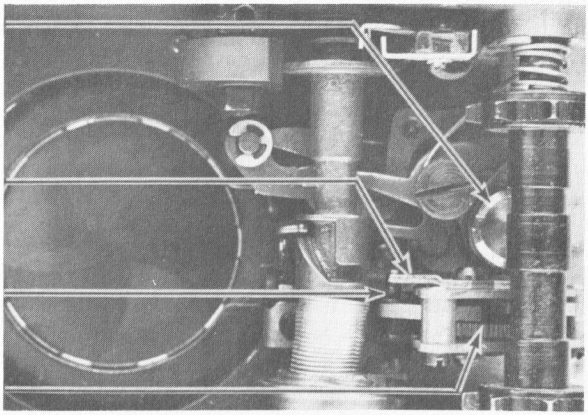


FIGURE 36

We can change the amount of retard by turning the speed knob on the front of the camera. The speed knob turns the speed cam, Fig. 36, to control the position of the retard lever. And the retard lever, in turn, controls the position of the spring-loaded first gear segment.

Notice that the speed cam also controls the position of the BULB LEVER, Fig. 37. At all of the instantaneous speeds, the speed cam holds the latching end of the bulb lever down --away from the BULB LUG on the main drive column.

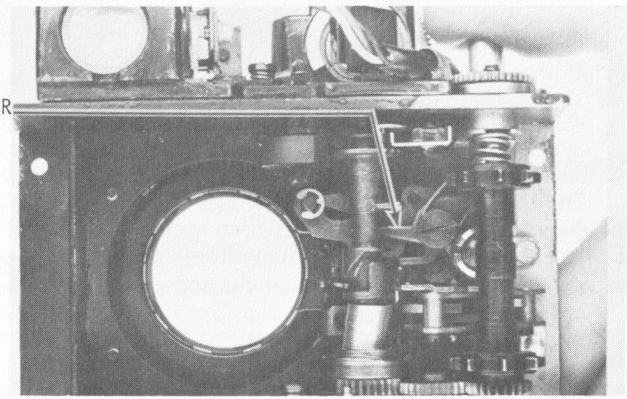


FIGURE 37 SHUTTER HELD OPEN ON "BULB"

But at the "bulb" setting, Fig. 37, the speed cam allows the spring-loaded bulb lever to swing up. Now, when you release the

shutter the inner release lever pushes the bulb lever down slightly, into the path of the bulb lug on the main drive column. So as the main drive column rotates and opens the blades, the latching end of the bulb lever catches the bulb lug. The bulb lever then prevents the main drive column from completing its rotation (to close the blades) as long as you hold the release plunger depressed.

When you let up on the release plunger, the inner release lever frees the bulb lever -- the bulb lever spring then pulls the bulb lever up to disengage the main drive column.

The one remaining function of the main drive column involves the operation of the sync contacts. The CONTACT CLOSING CAM at the top of the main drive column and the STAR WHEEL CAM just below the contact closing cam control the sync delay and the contact closure, Fig. 38.

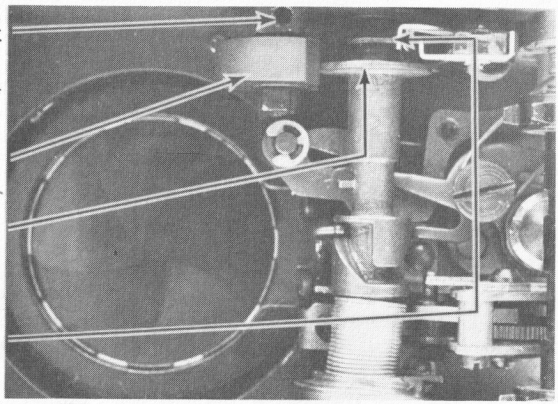


FIGURE 38 *DESCRIBED LATER IN TEXT

In the Argus C-4, you have a choice between either "M" sync or "X" sync (or, in some models, between "F" sync and "X" sync) -- you learned the meaning of these terms in your lesson, "Complex Escapement Retard Shutter -- Part I." Both sync delay times are provided by the CONTACT BLOCK shown in figure 39 -- and the switch on the camera top cover plate (from which you unsoldered the sync wires) electrically determines which sync action is delivered.

On "M" sync, as you know, the flash is fired and the shutter opening is delayed for a fraction of a second while the flashbulb reaches its peak intensity. In the Argus C-4, the delay is provided by the SYNC PALLET which engages the teeth cut in the star

wheel cam, Fig. 38. So the sync pallet delays the rotation of the main drive column while the flashbulb reaches its peak intensity.

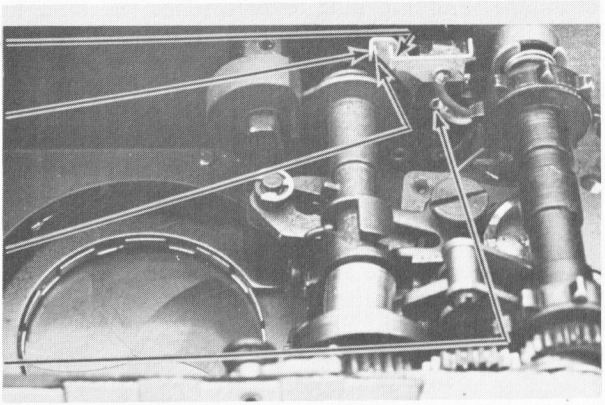


FIGURE 39

You can see the contact closure by using your finger to restrain the release rotation of the main drive column. Notice that as the main drive column first starts to turn, the contact closing cam pushes the MOVABLE CONTACT BLADE against the fixed "M" contact, Fig. 39. During this rotation, the sync pallet slows down the movement of the main drive column.

Then, as the main drive column continues its rotation, the contact closing cam frees the movable contact blade. The movable contact blade swings to its left (under its own tension) to strike the fixed "X" contact once the blades are fully open.

At the last degree of main drive column rotation, the sync cam pushes the movable contact blade away from the fixed "X" contact to break the "X" flash sync circuit. Even though both the "M" and the "X" contacts close during every shutter operation, only one sync time is provided -- depending on the position of the sync switch on the top cover plate.

DISASSEMBLY OF THE ARGUS C-4 SHUTTER

As it now stands, the Argus C-4 shutter is easily accessible for routine cleaning and lubrication. However, you'll frequently have to go a little further in disassembly and remove the shutter blades, the leaf lever, and the main drive column. The reason is that dirt and grease may cause the shutter blades to stick together -- and operating the shutter with "frozen" shutter blades often causes additional damage.

For example, the mainspring may be distorted (or may break) -- or the leaf lever may break from the strain. So you'll have to disassemble the shutter blade assembly to clean the blades and the blade operating ring -- and you may have to remove the main drive column to replace the mainspring.

The shutter blade assembly is held by screws coming either from the front or from the back of the assembly -- the way in which the shutter blade assembly is mounted depends on the particular model. If the retaining screws come in from the back, the shutter blade assembly comes off as a complete unit. But if the screws come in from the front, as in our example, the many individual parts of the shutter blade assembly are loose after removing the screws. So you must be very careful during disassembly to note the positions of the individual parts.

Lay the camera on your workbench with the lens mount facing you, as in figure 40. Now, remove the five screws pointed out in figure 40 -- be careful that you don't disturb the shutter blade assembly.

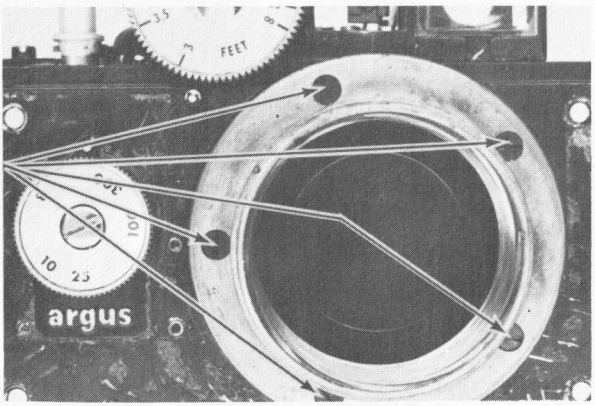


FIGURE 40

Then, lift off the lens mounting ring, placing it on your workbench. Next, lift off the first plate, Fig. 41, and place it next to the lens mounting ring. Lift off the second plate, Fig. 42, placing it next to the first plate -- you can now see the shutter blades and the brass blade spacers over the screw holes, Fig. 43. Lift out the shutter blades and the five blade spacers (which just provide clearance for the shutter blades).

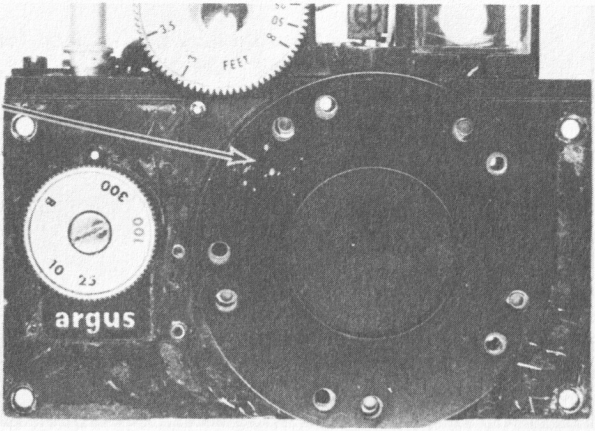


FIGURE 41

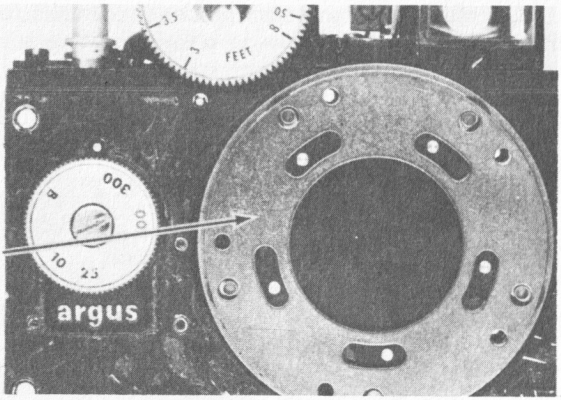


FIGURE 42

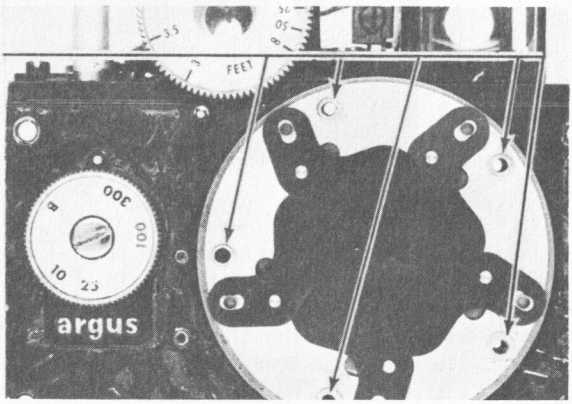


FIGURE 43

Next, lift off the shutter blade mounting plate, Fig. 44, and the blade operating ring, Fig. 45. Remove the brass plate and the black base plate, Fig. 46, in that sequence -- remember, keep these parts in order for reassembly. Figure 46 also points out the end of the leaf lever that engages the forked tab on the blade operating ring.

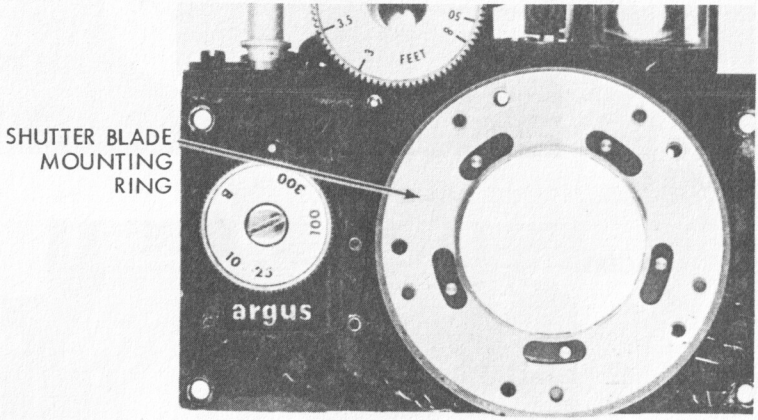


FIGURE 44

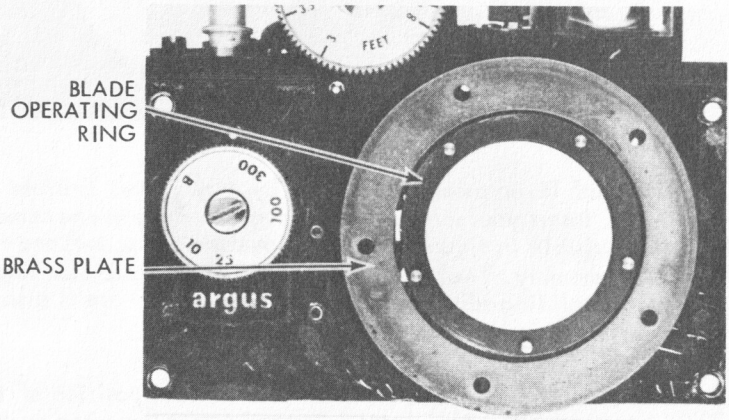


FIGURE 45

You can now see the five spacers sitting within the holes in the felt pad, Fig. 47 -- lift out the five spacers to prevent loss.

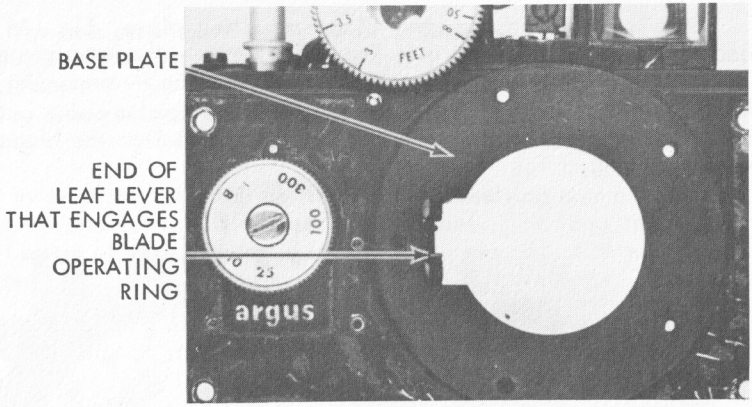


FIGURE 46

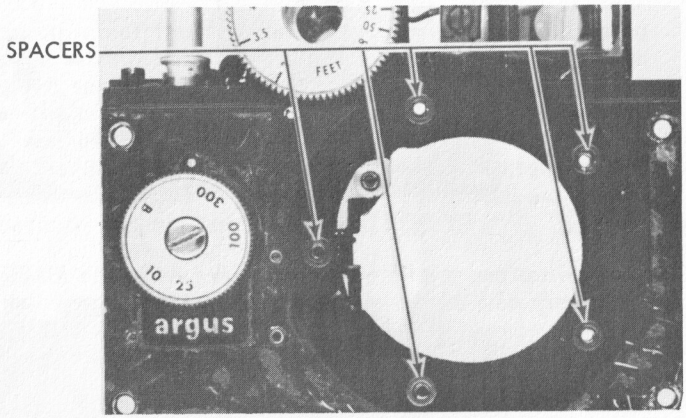


FIGURE 47

The leaf lever assembly is held by two screws (visible in figure 35). Insert your screwdriver through the hole in the camera body (also visible in figure 35) and remove the two screws and the leaf lever assembly. The holes in the leaf lever plate are elongated, permitting a sliding adjustment for the leaf lever -- we'll discuss this adjustment during reassembly.

There is also an adjustment on the vertical position of the main drive column. The main drive column is mounted on two threaded pivots -- one at either end. By turning one pivot out and the other in, you can change the vertical position of the main drive column. Of course, removing the main drive column disturbs the adjustment -- so for now, notice that the star wheel cam

on the main drive column is approximately centered on the sync pallet, Fig. 38.

NOTE: Removing the main drive column requires re-tensioning the mainspring on reassembly. The correct amount of initial tension must be applied to the main-spring to bring the 1/300 second shutter speed into time. Since your next lesson describes the methods of testing shutter speeds, we'll just go through the disassembly and tensioning procedures in this text.

To remove the main drive column, you should first let off the mainspring initial tension. The trick in letting off the initial tension is to release the shutter without cocking (and thereby tensioning) the mainspring. Since you aren't adding tension to the mainspring by cocking the shutter, each revolution of the main drive column lets off one turn of initial tension.

Using your screwdriver blade, push up on the released-position latch -- thereby disengaging the main drive column. The main drive column now moves from its released position to its "ready" position, held by the inner release lever. Next, release the shutter by depressing the release plunger. The main drive column then runs through its release cycle and lets off one turn of initial tension.

Repeat this procedure until the mainspring cannot turn the main drive column through its cycle -- that is, until there isn't enough tension left to turn the main drive column. Then, use your finger to turn the main drive column in the release direction and let off any remaining tension. You should now know how many turns of initial tension were originally on the spring.

To remove the main drive column, you must loosen the two threaded pivots. The upper pivot, on top of the mechanism, may be reached through the access hole in the rangefinder base plate, Fig. 48. But we'll remove the rangefinder assembly so you can more easily see the upper pivot and the other adjustments. The rangefinder assembly is one complete unit held to the shutter mechanism by two screws.

NOTE: The holes in the rangefinder base plate (for the two screws) are elongated, permitting a sliding adjustment for the rangefinder. If you remove the rangefinder, you may have to make the sliding adjustment on reassembly

(so the rangefinder disc properly engages the focusing ring). But to make things easier, you can simply scribe around the edge of the rangefinder base plate before removal. Then, on reassembly, position the rangefinder according to your scribe lines.

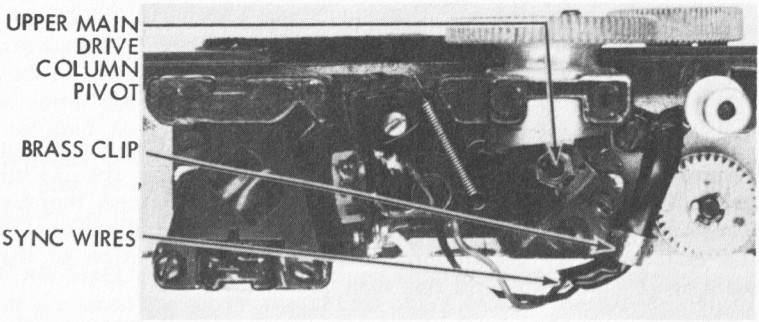


FIGURE 48

Bend back the brass clip holding the sync wires, Fig. 48, and move the sync wires away from the rangefinder assembly. Now, remove the two rangefinder retaining screws pointed out in figure 49 (notice that one of the screws also holds the brass clip for the sync wires). Finally, lift the complete rangefinder assembly up and off the camera body.

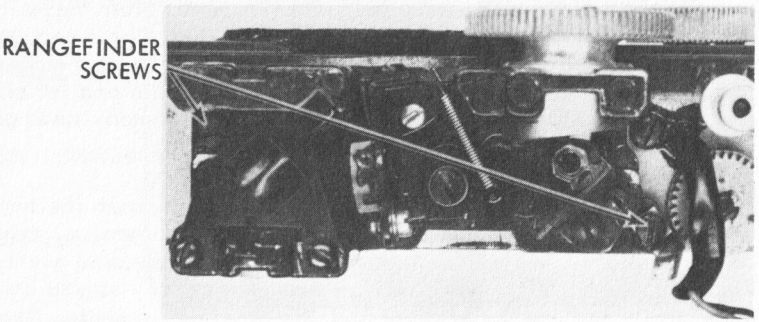


FIGURE 49

Before you loosen the pivots, try moving the main drive column up and down with your finger -- mentally note the amount of endplay you can feel. On reassembly, you'll want to adjust the pivots for this slight endplay in the main drive column.

The upper pivot for the main drive column is now clearly visible, Fig. 50. A hexagonal nut holds the threaded pivot in its

adjusted position. Loosen the hexagonal nut and turn the pivot about two turns in a counterclockwise direction -- the upper end of the main drive column is now free.

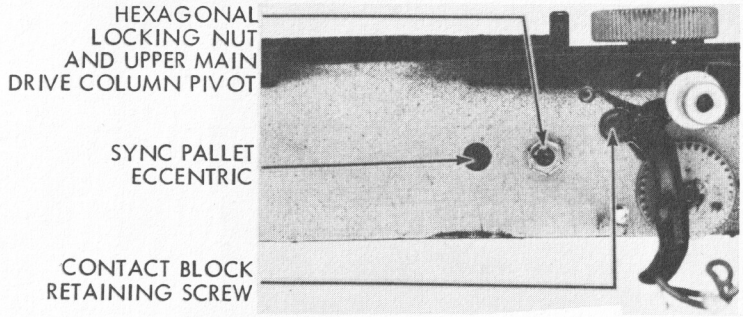


FIGURE 50

Next, locate the cover screw for the lower pivot at the bottom of the assembly, Fig. 51. Using a spline key of the proper size, take out the cover screw. There may be slugs under the cover screw -- if so, remove the slugs to reach the lower pivot.

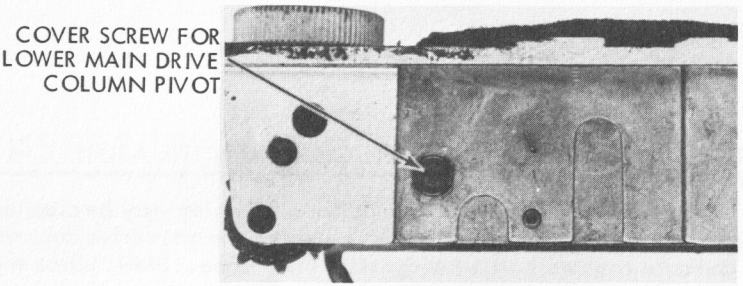


FIGURE 51 BOTTOM OF ASSEMBLY

Looking through the cover screw hole, locate the lower main drive column pivot -- this pivot has a left-hand thread. So turn the lower pivot in a clockwise direction until you can lift out the main drive column and the mainspring.

Figure 52, showing the main drive column, points out the name of each lug and cam. If you'll look into the cavity at either end of the main drive column, you should spot a ball bearing -- one ball bearing is spun into the base of the cavity at each end of the main drive column. The ball bearings, which engage the pivots, should not come out in normal disassembly -- but you should nonetheless check to make sure both ball bearings are present.

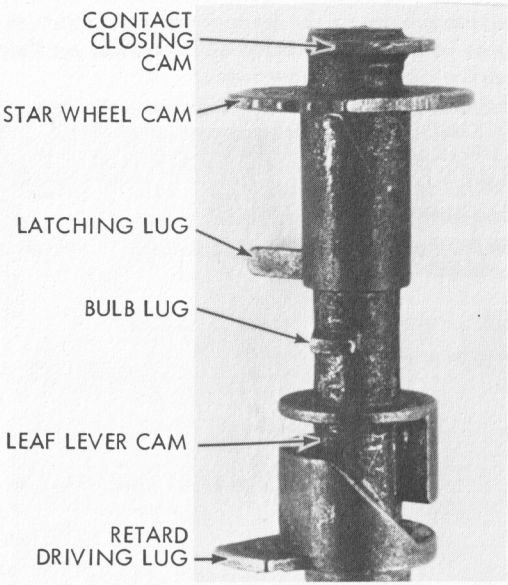


FIGURE 52 MAIN DRIVE COLUMN

REPLACING THE MAIN DRIVE COLUMN IN THE ARGUS C-4

The parts remaining in the shutter mechanism may be cleaned without further disassembly. After cleaning the main drive column, lubricate the two ball bearings with moly-lube. Now, place the mainspring in position on the wind cam (you can see the proper mainspring placement in figure 35).

Seat the upper end of the main drive column first -- then, swing the lower end into position. Make sure that the upper end of the mainspring hooks behind the retard driving lug on the main drive column.

The main drive column should now be in the released position -- that is, with its latching lug engaged by the released-position latch.

Next, turn down the two pivots to hold the main drive column. Adjust the pivots as previously described until the star wheel cam (on the main drive column) centers on the sync pallet. Remember to leave the slight endplay in the main drive column.

For now, we will put two turns of initial tension on the mainspring. If everything is working properly, two turns of tension should be sufficient to cock and release the shutter. But the initial tension may require further adjustment to bring in the shutter speeds.

Cocking the shutter adds initial tension to the mainspring. So we want to cock the shutter twice without releasing it -- the mainspring then retains the initial tension.

First, cock the shutter by turning the sprocket in the film-advance direction. Then, turn the main drive column slightly in a clockwise direction (as seen from the top of the mechanism) until it is latched by the released-position latch. Although the main drive column is now in its released position, the lower end of the transfer shaft still blocks the wind cam -- preventing you from cocking the shutter again. So just depress the release plunger -- that moves the transfer shaft below the lug on the wind cam. Now, cock the shutter a second time by turning the sprocket.

You have just applied two full turns of initial tension to the mainspring. Once again, turn the main drive column clockwise until it is held by the released-position latch and depress the release plunger. You can now cock and release the shutter in the normal manner.

Test the shutter operation at all of the shutter speeds. Then, set the speed knob to "bulb" -- cock and release the shutter, but hold the release plunger depressed. While the main drive column is held by the bulb lever, check the relationship between the bulb lug (on the main drive column) and the latching end of the bulb lever -- the bulb lever should be centered on the bulb lug. If the bulb lever does not catch the bulb lug properly, you may have to make another slight adjustment to the main drive column pivots.

REPLACING THE ARGUS C-4 SHUTTER BLADE ASSEMBLY

NOTE: We removed the leaf lever after taking out the shutter blade assembly. However, we'll reassemble the shutter blade assembly before replacing the leaf lever -- that way, we can test the operation of the blade operating ring for free movement.

Working from the front of the camera, replace the five spacers within the holes in the felt pad. Seat the black base plate with

its cutout positioned as shown in figure 46, and align the holes in the base plate with the screw holes in the front plate. Next, replace the brass plate, aligning its screw holes with the holes in the base plate. Seat the blade operating ring with its forked tab pointing down and passing through the cutout in the base plate.

Locate the five raised "dimples" on the shutter blade mounting ring -- these "dimples," which hold the shutter blades, must go up. Seat the shutter blade mounting ring and align its five holes.

Now, rotate the blade operating ring clockwise to the full-open position (it's much easier to replace the shutter blades in the open position). Place the first blade over the locating pins nearest the forked tab on the blade operating ring. Then, replace the next four blades in clockwise rotation.

Depending on the particular camera, you now have one or more blades left over. These extra blades act as spacer and cover blades. Place the sixth blade over the pins for the first blade, and place the seventh blade over the pins for the second blade -- that is, just start over with your clockwise rotation until you have installed all of the shutter blades. Then, position the five blade spacers over the screw holes.

You must be very careful while seating the second plate in position -- otherwise, you can disturb the positions of the shutter blades and the blade spacers. The larger holes in the second plate go over the blade pins, while the smaller holes align with the screw holes in the blade mounting ring.

Finally, seat the first plate and the lens mounting ring. Replace the five retaining screws to hold the shutter blade assembly in place.

To test the operation, turn over the shutter mechanism and locate the forked tab on the blade operating ring. Use your screwdriver blade to move the forked tab up and down -- opening and closing the shutter blades. The blade operating ring should move smoothly and freely.

REPLACING AND ADJUSTING THE LEAF LEVER IN THE ARGUS C-4

Before replacing the leaf lever, lightly lubricate the leaf

lever cam in the main drive column with moly-lube. Now, seat the leaf lever in place -- one end of the leaf lever hooks to the forked tab on the blade operating ring, while the other end fits within the leaf lever cam in the main drive column. Replace the two screws to hold the leaf lever in place.

You can now cock and release the shutter to test the operation. Remember, we mentioned that the leaf lever has a sliding adjustment -- by loosening the two screws, you can slide the entire leaf lever assembly up or down. If the leaf lever is sitting too low, the shutter blades won't be held fully open on "bulb"; and if the leaf lever is sitting too high, the blades may not close completely.

Set the speed knob to "bulb" and depress the release plunger -- hold the release plunger depressed to keep the blades open. If the blades aren't fully open, loosen the two screws holding the leaf lever. Now, still holding the blades open on "bulb," slide the leaf lever assembly up until the blades are fully open -- as they are in figure 37. And, after making the adjustment, make sure the leaf lever retaining screws are snugly tight.

ADJUSTING THE SHUTTER SPEEDS IN THE ARGUS C-4

There are two shutter speed adjustment points in the Argus C-4 -- one is the amount of initial tension on the mainspring; and the other is the position of the speed cam.

Remember, you can alter the amount of initial tension by full-turn increments. Check the shutter operation at 1/10 second, the slowest shutter speed -- if you have sufficient initial tension on the mainspring, the shutter should run through smoothly at 1/10 second.

But the fastest shutter speed -- 1/300 second -- is your indication of the precise amount of initial tension necessary. You'll soon learn the procedures for testing shutter speeds. For now, remember that you must add initial tension to make the 1/300 second faster, and let off initial tension to make the 1/300 second slower.

NOTE: If you have to add more than two turns of initial tension, you may note that the mainspring "buckles" slightly. A slight amount of buckle won't damage the mainspring. But if the buckle is excessive, there is probably some other reason that the shutter speed isn't coming up to 1/300 second. Rather than adding more initial tension, check thoroughly for a camera malfunction.

The initial test of the speed cam position is similar to that we described for the Argus C-3. You should have no retard on the fastest speed (1/300 second), and just a whisper of retard on the next-to-the-highest speed (1/100 second). But for critical accuracy, you can adjust the speed cam according to the procedures we'll describe in your next lesson.

The Argus C-4 speed cam has an in-and-out adjustment. So for less retard (and thereby a faster speed), we move the entire speed cam in -- toward the escapement. And for more retard (and thereby a slower speed), we move the speed cam toward the speed knob.

To reach the speed cam adjustment point, first take off the speed knob by removing its center screw -- there's a compression spring under the speed knob. Now, locate the brass speed control disc with its locking spline screw, Fig. 53. By loosening the locking screw, you can rotate the speed control disc and thereby change the amount of retard for the speeds of 1/100 second through 1/10 second.

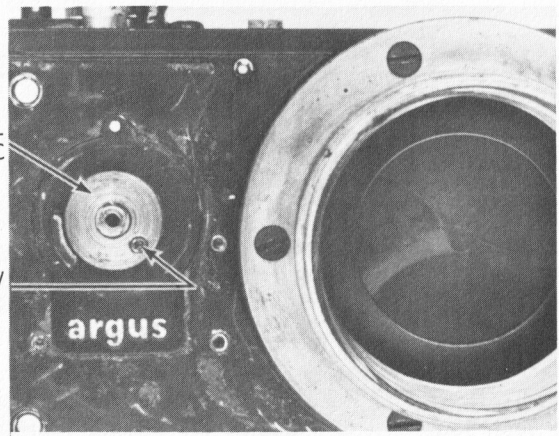


FIGURE 53

ADJUSTING THE SYNC DELAY IN THE ARGUS C-4

The methods of testing sync delay are also covered in future lessons. So for now, we'll just point out the specific adjustment points in the Argus C-4.

Remember, the "X" contacts should be held apart by the contact closing cam on the main drive column. And, when the

blades are fully open, the "X" contacts should close to fire the flash. By restraining the main drive column during its release rotation, you can visually check for the proper operation of the movable contact blade.

The adjustment for the opening and closing of the sync contacts is located on the top of the camera. The screw shown in figure 50 holds the contact block -- by loosening the screw, you can shift the contact block in position. Move the contact block either closer to or farther from the contact closing cam (on the main drive column) until the contacts open and close as previously described.

There is also an adjustment for the length of the "M" sync delay. To change the "M" sync delay, you can adjust the depth that the sync pallet engages the star wheel cam on the main drive column.

For example, say you've adjusted the contact block for proper operation of the movable contact blade -- "X" sync now tests correctly. But when checking "M" sync, you find that the delay is too long (the "M" sync delay should be between 17 and 19 milliseconds). In other words, you must decrease the depth of sync pallet engagement.

First, loosen the spline locking screw accessible through the hole above the sync pallet, Fig. 38. Loosening the locking screw allows you to turn the sync pallet eccentric, Fig. 50. And the sync pallet eccentric moves the sync pallet either closer to or farther from the star wheel cam.

COMPLETING THE ARGUS C-4 REASSEMBLY

Replace the rangefinder with its two screws. Hook the sync wires under the brass clip and press the clip over the wires, as shown in figure 48. Make sure that neither the wires nor the clip interfere with the upper wind gear, Fig. 48.

Now, seat the front plate/shutter assembly in the camera body and replace the four retaining screws. Set the rangefinder disc to infinity and replace the lens focusing ring with its retaining ring -- remember, the last tooth on the focusing ring should engage the rangefinder disc at infinity.

Since you disturbed the lens focus by removing the lens, you must readjust the lens for infinity during installation. That is, if

you attach a ground glass to the focal plane, you can screw in the lens until an infinity target viewed on the ground glass is in sharp focus.

First, loosen the three spline screws around the knurled lens adjusting ring, Fig. 28. Now, while watching the ground glass image of an infinity target, screw in the lens until the image is at its sharpest focus. Without changing the lens position, rotate the lens adjusting ring until the hole for the lens pin screw, Fig. 28, aligns with the slot in the focusing ring. Then, replace the lens pin screw and tighten the three spline screws around the lens adjusting ring.

The remaining reassembly procedure just involves reversing the order of your disassembly.

THE ROLLEI 35

Both the Argus C-3 and the Argus C-4 use the built-in shutter principle to provide extremely rugged, dependable, and simple designs. The same shutter concept, scaled down in size, makes possible the ultra-compact camera -- the tiny full-frame Rollei 35, Fig. 54, is a good example.

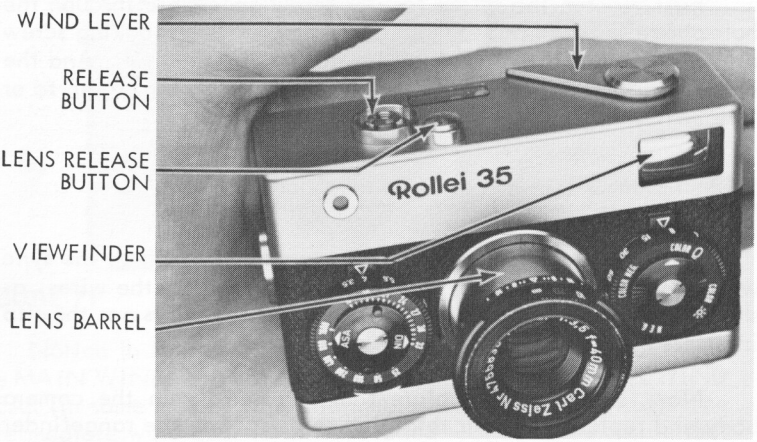


FIGURE 54

NOTE: Several half-frame 35mm cameras feature comparable compactness using conventional modular shutters. The half-frame (sometimes called "single-frame") camera uses just half of the normal 35mm negative format -- so

you get twice as many pictures on a roll of film. The Rollei 35, however, came out as the smallest full-frame (sometimes called "double-frame") 35mm camera -- the negative format is the same size as in the Argus C-3 or C-4.

The highly-refined Rollei 35 packs many of today's favorite features into pocket-size proportions. Consequently, the Rollei 35 has features you have not yet covered in your course -- in particular, the cross-coupled CdS (cadmium sulfide) exposure meter. But the key to the compactness is the ingenious built-in shutter -- so, in this lesson, we'll concentrate on the unique shutter and see how the shutter controls are cross coupled to the exposure meter.

Figure 55 pictures the shutter blades driving and timing mechanisms in the Rollei 35. Unlike the Argus models we examined earlier, the shutter blades (and diaphragm leaves) in the Rollei 35 are between the optical elements of the lens. Long rods connect the shutter blades and diaphragm leaves to the mechanism shown in figure 55.

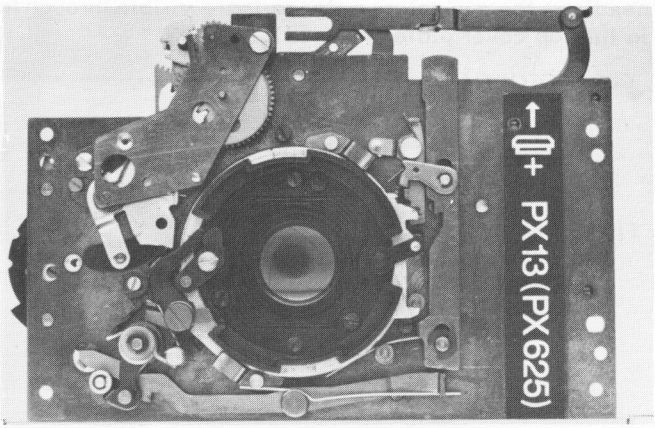


FIGURE 55 ROLLEI 35 SHUTTER MECHANISM

What may surprise you is that figure 55 shows a Compur between-the-lens shutter. Certainly, the Rollei 35 shutter bears little resemblance to the Compur designs you studied in your lessons, "Complex Escapement Retard Shutter, Parts I and II." Instead, the Rollei 35 shutter is a specially-made Compur -- you'll find it in no other camera.

NOTE: Recently, Rolleiflex introduced two close cousins of the Rollei 35. Both the Rollei B35 and the Rollei C35 are just less-expensive versions of the camera shown in

figure 54. The Rollei B35 has a non-coupled selenium-cell exposure meter (rather than the cross-coupled CdS exposure meter); and the Rollei C35, the simplest camera of the line, eliminates the exposure meter altogether.

Before we examine the shutter in the Rollei 35, we'll take a quick look at the camera itself. For additional compactness, the lens barrel collapses into the camera body. To use the Rollei 35, first pull the lens straight out and turn it a partial turn clockwise -- this locks the lens barrel in place, as shown in figure 54.

The shutter must be cocked to return the lens to its storage position. Cock the shutter by advancing the WIND LEVER, Fig. 54. Now, depress the LENS RELEASE BUTTON (to the front of the shutter RELEASE BUTTON in figure 54). Turn the lens barrel slightly counterclockwise and push it into the camera body.

The shutter controls are on the front of the camera. Select the shutter speeds -- 1/2 second through 1/500 second and "bulb" -- by turning the SPEED KNOB, Fig. 56. Notice that turning the speed knob moves a red pointer above the exposure meter needle -- these exposure meter parts are visible through the window in the top cover plate, Fig. 57.

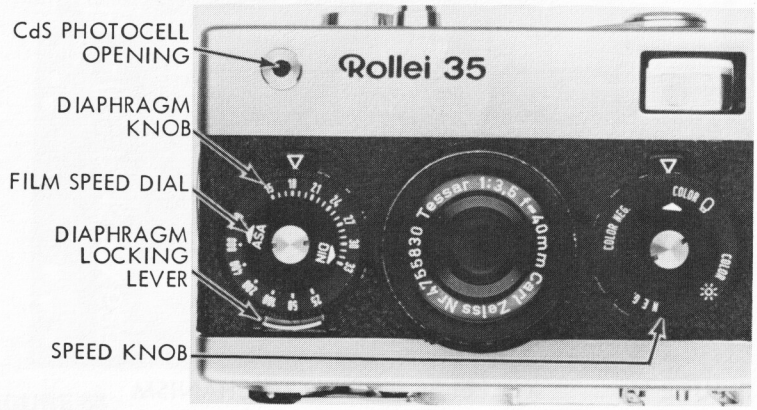


FIGURE 56

Both the diaphragm and film speed controls also position the red pointer. Set the proper film speed by turning the FILM SPEED DIAL on the front of the DIAPHRAGM KNOB, Fig. 56. To set the f/stop, you must first release the diaphragm knob -- the diaphragm knob locks in place at each selected aperture. First, push up on the DIAPHRAGM LOCKING LEVER, Fig. 56 -- while holding the diaphragm locking lever up, turn the diaphragm knob to the desired f/stop.

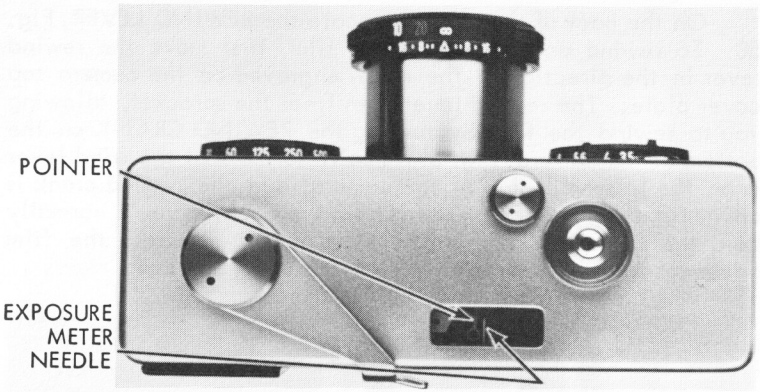


FIGURE 57

When the pointer is directly over the exposure meter needle, the film speed/shutter speed/diaphragm opening combination is correct for the existing light conditions. So you can select the f/stop you want (depth-of-field control), and then align the pointer using the speed knob -- or you can select a shutter speed (motion-stopping control) and align the pointer using the diaphragm knob.

We mentioned earlier that the Rollei 35 uses a CdS exposure meter. In a later lesson, you will learn the theory behind exposure meters. But for now, you should keep in mind that a CdS cell acts as a light-sensitive variable resistor -- that is, the light striking the CdS cell (called the "photocell") changes the resistance of the cell to current flow. The brighter the light intensity, the lower the resistance of the cell -- and, as a result, the greater the amount of current flowing through the cell.

The current flowing through the CdS cell moves the needle, Fig. 57, according to the light intensity. The amount that the needle swings upscale (to your right in figure 57) indicates how much light is striking the CdS cell. As we increase the light intensity, the more the needle moves to the right.

Any CdS exposure meter requires a battery to supply the current flowing through the CdS cell. The CdS cell then regulates the current, according to the amount of light, to make the needle move the proper distance. Also, the CdS cell must be in a position where it can "see" the light which will later expose the film. The CdS cell opening in the Rollei 35 is on the front of the camera, Fig. 56. But the camera back must be removed to reach the battery, as we'll explain in a moment.

On the back of the camera, locate the REWIND LEVER, Fig. 58. To rewind an exposed roll of film, first move the rewind lever in the direction of the arrow engraved on the camera top cover plate. The rewind lever then frees the sprocket, allowing you to rewind the film by turning the REWIND CRANK on the bottom of the camera, Fig. 59. You'll notice that the wind lever is on the left-hand side of the camera, and the rewind crank is on the right-hand side (as viewed from the back, as you'd normally hold the camera). So, unlike most 35mm cameras, the film advances from right to left.

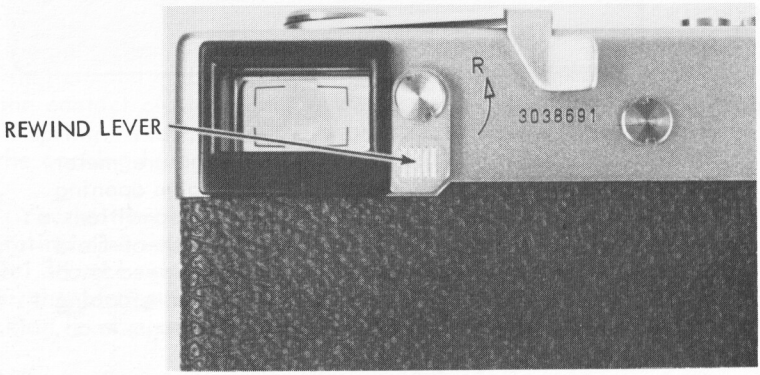


FIGURE 58

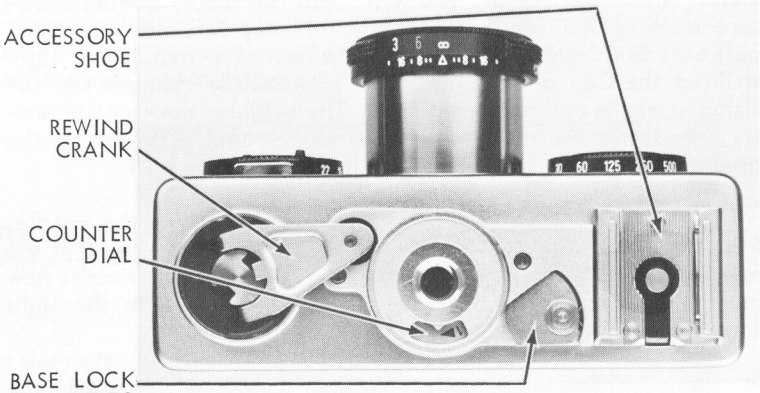


FIGURE 59

The COUNTER DIAL and the ACCESSORY SHOE are also on the bottom of the camera, Fig. 59. The accessory shoe provides a "hot" contact to the flash unit -- no flash cord is necessary, if you don't mind mounting your flash unit on the bottom of the camera.

To remove the camera back, turn the BASE LOCK, Fig. 59, toward the back of the camera. Now, slide the camera back straight down and off the camera body.

The spring-loaded counter dial, remaining with the camera back, immediately returns to its starting position -- three calibration spaces past the "1" calibration. When you replace the camera back, you must cock the shutter three times to align the "1" calibration with the index.

Looking inside the camera back, locate the black ratchet teeth of the counter dial, Fig. 60. The COUNTER DIAL DRIVING PAWL projects through a slot in the bottom plate of the camera, Fig. 61, to engage the ratchet teeth.

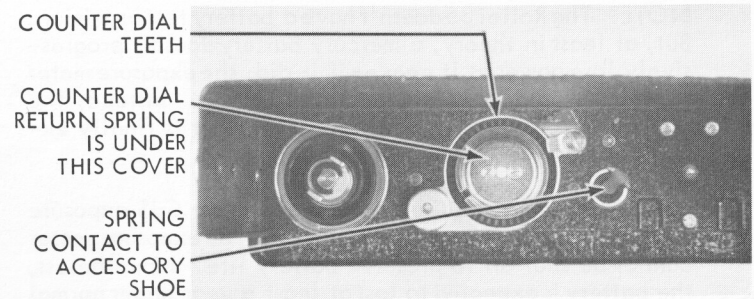


FIGURE 60 INSIDE OF CAMERA BACK

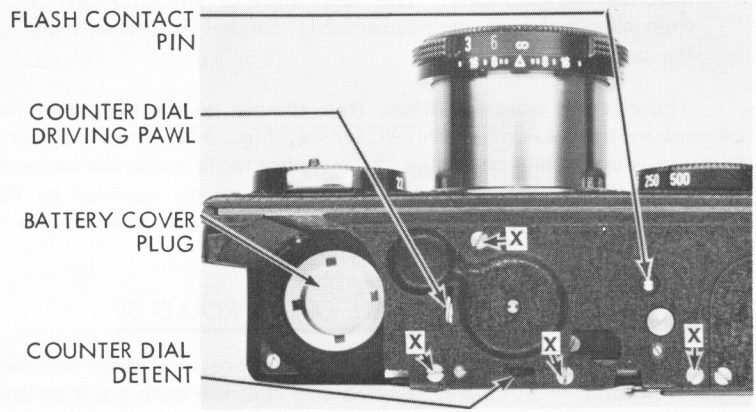


FIGURE 61

Cock the shutter slowly and observe how the counter dial driving pawl moves forward -- toward the front of the camera. This forward motion advances the counter dial one tooth to the

next film frame calibration (when the camera back is installed). The two prongs of the COUNTER DIAL DETENT, Fig. 61, hold the counter dial in its new position.

When you release the shutter, the counter dial driving pawl moves back to its starting position -- moving in this direction, the spring-loaded pawl does not actuate the counter dial. The counter dial driving pawl is now ready to again advance the counter dial the next time you cock the shutter.

Figure 61 also shows the cover plug for the exposure meter battery. To replace the battery, use a coin to unscrew the cover plug. The exposure meter is powered by a single PX-13 Mallory battery.

NOTE: The Rollei 35 doesn't have a battery test provision. But, at least in theory, a mercury battery doesn't progressively lose power as it ages -- if it did, the exposure meter readings would vary as the battery aged. Instead, the mercury battery delivers full power until it is finally exhausted, at which time it dies swiftly.

Another missing feature, standard in many CdS exposure meters, is the on-off switch -- the Rollei 35 exposure meter cannot be shut off to preserve battery life. Nonetheless, the battery is expected to last at least a year under normal use. If the camera is in its carrying case, little or no light reaches the CdS cell. The resistance of the CdS cell is then so great that no appreciable current is drawn from the battery.

There is one more important item to note on the bottom of the camera -- the FLASH CONTACT PIN, Fig. 61. The flash contact pin is an extension of the "X" sync contacts inside the camera. When you replace the camera back, the spring contact to the accessory shoe, Fig. 60, presses against the flash contact pin to complete the "X" flash sync circuit.

REMOVING THE BOTTOM PLATE OF THE ROLLEI 35

The camera bottom plate and the film pressure plate are two separate parts -- but we'll remove and replace both parts as one assembly.

First, take out the four bottom plate retaining screws -- each screw is marked by an "X" in figure 61. Now, swing the film pressure plate as far as it can go in the open direction -- the

film pressure plate should be sitting over the top of (and nearly perpendicular to) the bottom plate.

You cannot as yet lift off the bottom plate. The reason is that two tabs on the rear edge of the bottom plate fit under matching lugs in the camera body. So first lift the front edge of the bottom plate -- the edge toward the front of the camera -- and slide the complete assembly toward the back of the camera.

On reassembly, start with the film pressure plate installed on the bottom plate (the two parts can separate once you remove the bottom plate). Once again swing the film pressure plate as far as it can go in the open direction. Now, slide the bottom plate, together with the film pressure plate, on from the back of the camera toward the front. You may have to reposition the flash contact pin slightly, until it passes through its hole in the bottom plate.

> NOTE: As we continue through the disassembly, we'll describe the special timing and reassembly procedures. You might try replacing certain parts right after removing them -- just for practice while the procedure is still fresh in your mind. Reassembly is then simply a matter of reversing your disassembly sequence.

Now that you've removed the bottom plate, you can examine the parts on the bottom of the camera. To prevent loss, lift off the dust seal over the COUNTER ADVANCE LEVER and the insulator sleeve over the flash contact pin, Fig. 62 -- these two loose parts identify the Rollei 35 illustrated as being a recent model.

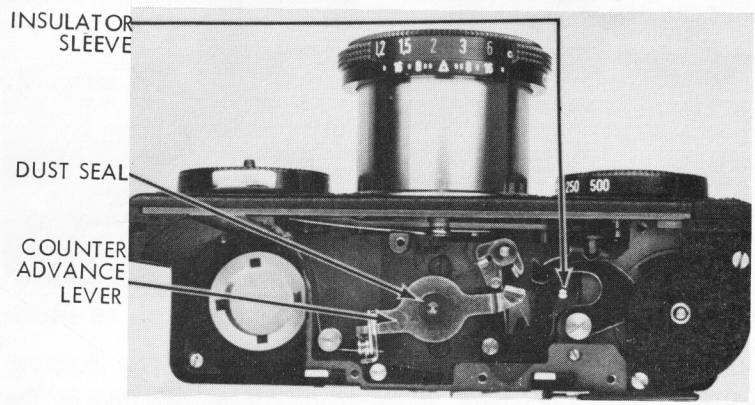


FIGURE 62

In figure 63, locate the COCKING LEVER, the counter dial actuating mechanism, and the sync contacts. The COCKING CAM is under the plate to the right of the cocking lever -- you can just see a corner of the cocking cam in figure 63.

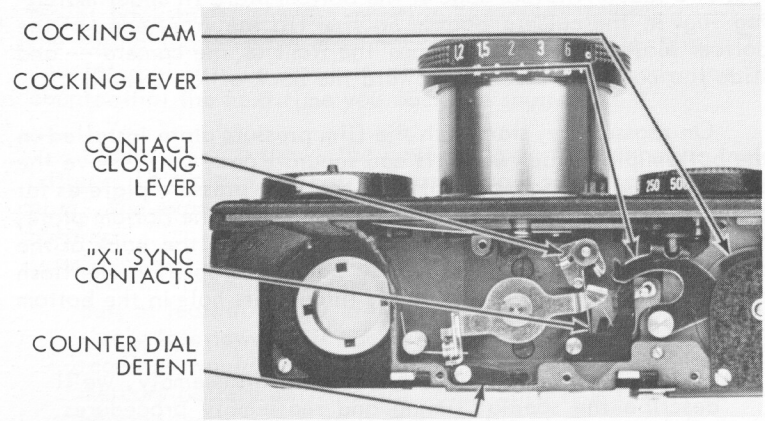


FIGURE 63 SHUTTER RELEASED

As you cock the shutter, notice how the cocking cam rotates to push the cocking lever toward the center of the camera. The two downward-projecting prongs on the cocking lever straddle a stud on the lower end of the main lever in the shutter. So as the cocking lever moves toward the center of the camera, it carries the main lever to the cocked position, Fig. 64.

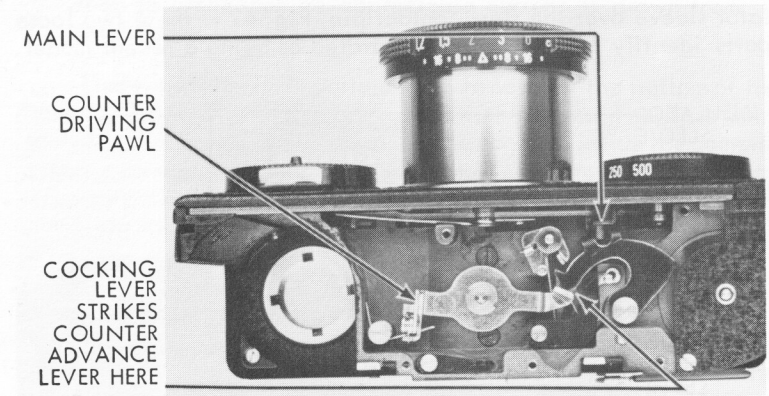


FIGURE 64 SHUTTER COCKED

The main lever is latched in the cocked position by the inner release lever -- the long, spring-loaded lever mounted on the front mechanism plate, Fig. 65.

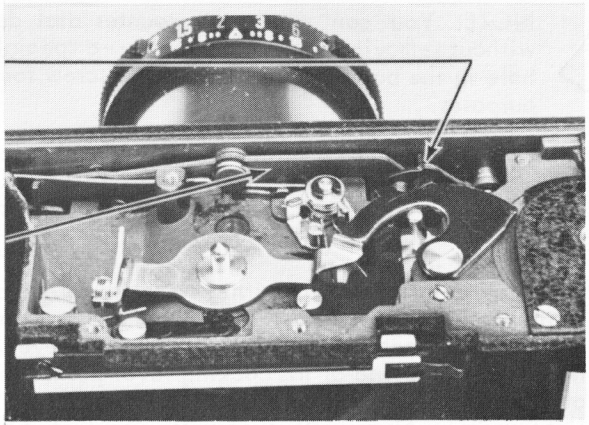


FIGURE 65

Watch the latching end of the inner release lever as you depress the release button. The linkage from the release button moves the latching end of the inner release lever up, toward the top of the camera, to free the main lever. Now, the visible (lower) end of the main lever moves from left to right during the release cycle.

Cocking and releasing the shutter also spotlights the actions of the counter dial actuating mechanism and the sync mechanism. At the end of the cocking cycle, the end of the cocking lever strikes the counter advance lever, Fig. 64. The counter advance lever then swings in a clockwise direction -- and the counter dial driving pawl, mounted to the left-hand end of the counter advance lever in figure 64, moves toward the front of the camera. Earlier, we noted how the forward motion of the counter dial driving pawl advances the counter dial to the next film frame calibration.

When you release the shutter, the main lever carries the cocking lever back to its starting position, Fig. 63. The spring-loaded counter advance lever then returns to the position shown in figure 63.

You can also see the counter dial detent more clearly in figure 63. If necessary, you can loosen the retaining screw and shift the position of the counter dial detent -- this adjustment may be required if the calibrations on the counter dial don't align precisely with the index. Remember, when the counter driving pawl returns toward the rear of the camera, the counter dial detent must hold the counter dial at its proper calibration -- against the tension of the counter dial return spring.

NOTE: You can reach the counter dial detent screw without removing the bottom plate --a special clearance hole in the bottom plate exposes the screw for adjustment purposes.

The "X" sync mechanism consists of the two sync contacts and the two-piece CONTACT CLOSING LEVER, Fig. 63. A light spring holds the upper section of the contact closing lever against the lower section.

Notice in figure 63, with the shutter released, that the end of the cocking lever is on the right-hand side of the upturned tab on the upper section of the contact closing lever. As you cock the shutter, the end of the cocking lever pushes the upper section of the contact closing lever aside -- against the tension of the light spring. Now, with the shutter cocked, Fig. 64, the end of the cocking lever is on the left-hand side of the upturned tab.

You learned in earlier lessons that the leaf lever or the blade operating ring usually closes the "X" sync contacts. But in the Rollei 35, the cocking lever is the part that closes the contacts when the blades reach the full-open position -- remember, the cocking lever always travels with the shutter's main lever.

During the release cycle, the end of the cocking lever catches the upturned tab on the upper section of the contact closing lever. The upper contact closing lever then pulls the lower contact closing lever from left to right -- and the lower contact closing lever closes the sync contacts to fire the flash.

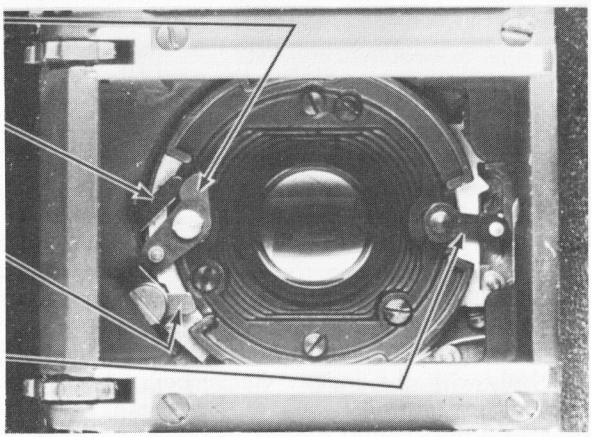


FIGURE 66

As yet, we've just pointed out the lower end of the main lever -- the end visible from the bottom of the camera. But you can see the upper end by looking inside the focal-plane aperture near the rear lens opening, Fig. 66. The leaf lever is visible just to the right of the main lever in figure 66.

The leaf lever is fixed to the end of a long shaft -- the shaft reaches along the lens barrel to the blade operating ring, located between the optical elements of the lens.

To see how the leaf lever works, first cock the shutter -- notice that the main lever now moves out of view to the left of the leaf lever. Then, using your tweezers, push the lower end of the leaf lever to your right -- this action opens the shutter blades.

As soon as you let go of the leaf lever, a spring on the blade operating ring (not yet visible) closes the shutter blades. But during normal operation, the main lever drives the leaf lever in both the opening and closing directions.

Depress the release button to disengage the main lever. As the upper end of the main lever moves from left to right, the spring-loaded pawl (just visible underneath the leaf lever in figure 66) strikes the stud on the lower end of the leaf lever. The main lever pawl then drives the lower end of the leaf lever from left to right, opening the shutter blades.

After the blades have been opened, the "finger" on top of the main lever strikes the upper end of the leaf lever. So, while completing its release cycle, the main lever drives the leaf lever in the opposite direction to close the shutter blades. The spring on the blade operating ring just holds the blades closed when the main lever is in the cocked position.

Figure 66 also points out the DIAPHRAGM CONTROL ARM to the right of the lens opening. Rotate the diaphragm knob on the front of the camera and notice how the diaphragm control arm moves up and down. The diaphragm control arm is connected by a long rod to the spring-loaded diaphragm control ring inside the lens -- we'll examine these parts after further disassembly.

REMOVING THE TOP COVER PLATE IN THE ROLLEI 35

You'll be able to see much of the semi-automatic exposure control linkage after you remove the top cover plate. First, use your multispan wrench to take out the shoulder screw and the screw

holding the rewind lever, Fig. 67. Lift off the rewind lever and the collar around the rewind shaft, shown in figure 68 -- notice that the shoulder on the collar (the smaller diameter) passes into the hole in the top cover plate.

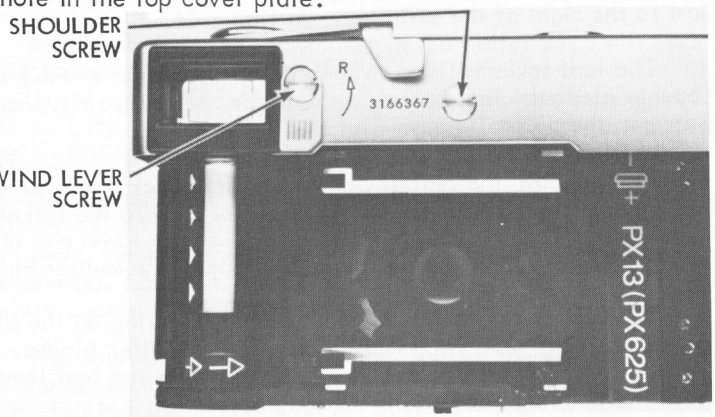


FIGURE 67

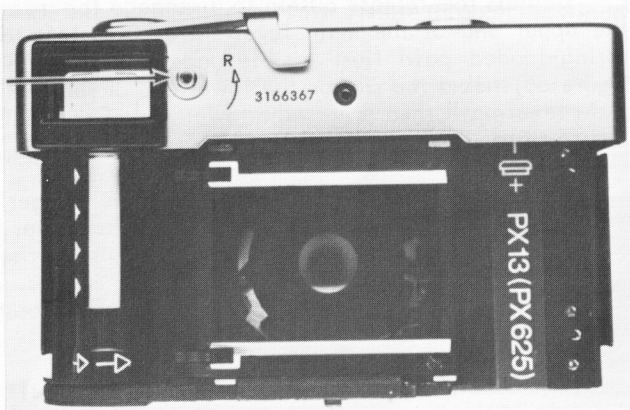


FIGURE 68

The rewind shaft itself is a little tricky to remove. The DETENT SPRING shown in figure 69 holds the rewind shaft in place. But if you'll look closely at the portion of the rewind shaft underneath the detent spring, you can see that one side of the shaft is flat -- rotate the rewind shaft until this flat section faces the detent spring.

Now, using a small screwdriver, push the detent spring away from the rewind shaft. While holding the detent spring aside, lift the rewind shaft out of the camera.

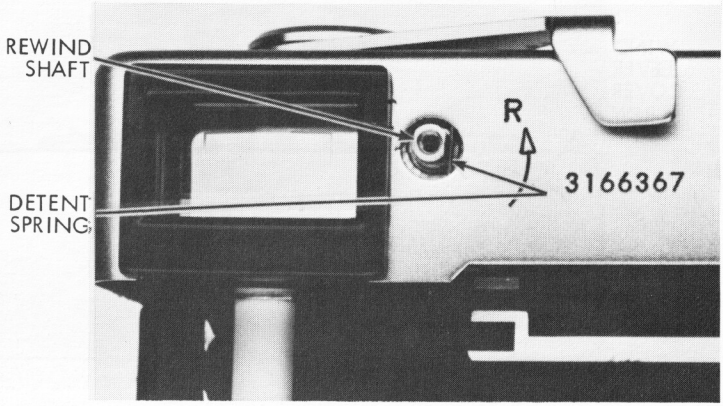


FIGURE 69

REASSEMBLY: A pin located eccentrically on the bottom of the rewind shaft fits under a lip on the sprocket gear shank -- you can see the lip by looking through the hole which receives the rewind shaft. When the sprocket gear is moved up, the sprocket is free to turn in either direction -- but when the sprocket gear moves down, the sprocket is locked to the wind mechanism. The rewind shaft raises or lowers the sprocket gear according to the position of the rewind lever.

To replace the rewind shaft, first position the sprocket gear at its "rewind" setting -- use your tweezers or a small screwdriver to lift the sprocket gear and free the sprocket. Now, while holding up the sprocket gear, rotate the sprocket with your finger -- until the sprocket gear is held in its raised position. Next, orient the rewind shaft with its flat side facing the detent spring. Hold the detent spring aside and insert the rewind shaft -- rotate the rewind shaft in a clockwise direction until the sprocket re-engages the wind mechanism (that is, until you cannot turn the sprocket with your finger). The rewind shaft should now be positioned as shown in figure 69.

Continuing with the disassembly, use your multispan wrench and unscrew the cover screw over the wind lever, Fig. 70. CAREFUL: There's usually a washer under the cover screw -- if you leave out the washer on reassembly, the cover screw will bind the wind lever.

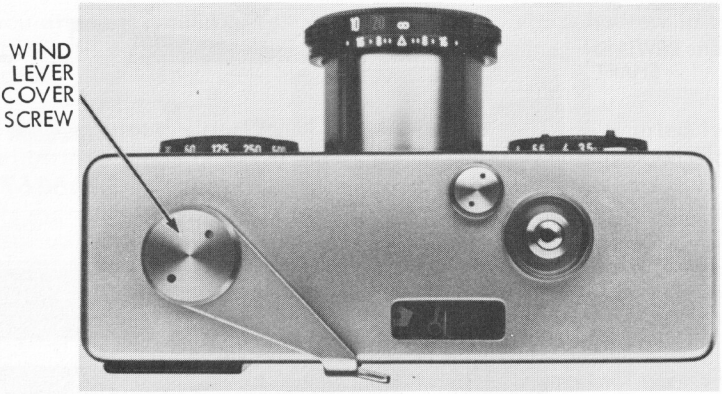


FIGURE 70

Next, take out the three wind lever screws, Fig. 71, and lift off the wind lever. Remove the two remaining top cover plate screws -- one at each end of the camera -- and slide the top cover plate up and off the camera body.

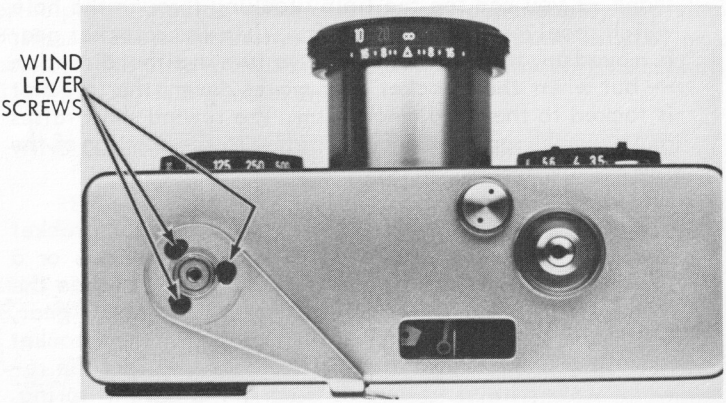


FIGURE 71

Notice in figure 72 that we have scribed the timing between the MAIN WIND GEAR and the black nylon INTERMEDIATE WIND GEAR (in some models, the intermediate wind gear is brass). The intermediate wind gear is spring loaded -- this is the spring that returns the wind lever after the cocking stroke. Since it is now possible to lift the main wind gear out of engagement with the intermediate wind gear, scribing the timing is a good precaution in the event the gears are accidentally disengaged.

After scribing the gear timing, replace the wind lever on the

main wind gear. Replace the three wind lever screws and the cover screw with its washer -- the cover screw prevents your lifting the wind lever to disengage the main wind gear. You can now cock the shutter to study the operation.

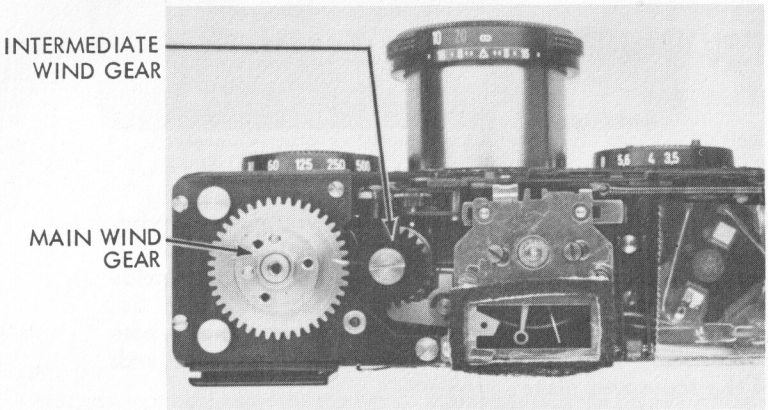


FIGURE 72

OPERATION OF THE SHUTTER PARTS AT THE TOP OF THE ROLLEI 35

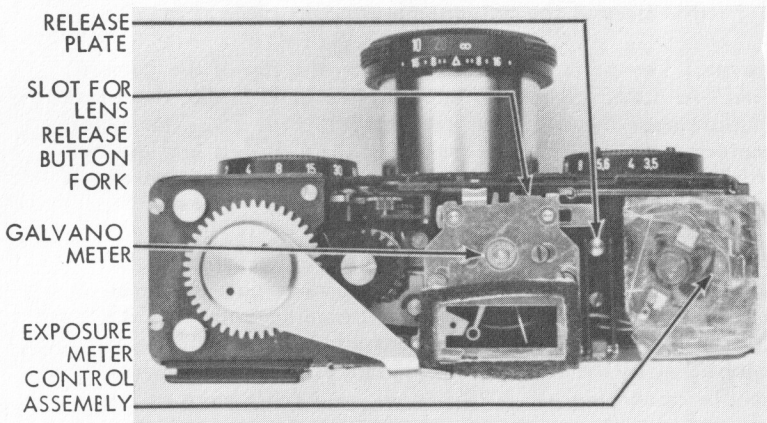


FIGURE 73

Cock the shutter by advancing the wind lever. To release the shutter, push down on the RELEASE PLATE, Fig. 73, with your screwdriver. The end of the release button shaft, remaining with the top cover plate, normally sits on the "dimpled" stud at the end of the release plate.

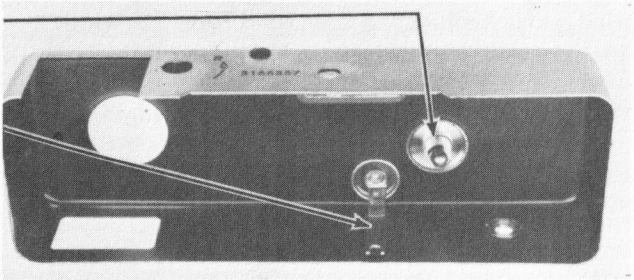


FIGURE 74 INSIDE OF TOP COVER PLATE

REASSEMBLY: There are two key points you must remember as you replace the top cover plate. First, the two flat sides of the release button shaft, Fig. 74, must fit inside the parallel walls of the release plate, Fig. 73. So, before you replace the top cover plate, turn the release button shaft until its flat sides are parallel with the ends of the top cover plate.

The second point is that the long fork extending from the bottom of the lens release button, Fig. 74, must straddle the lens latch inside the shutter. You cannot as yet see the lens latch. But as you install the top cover plate, make sure the lens release button fork feeds through the slot to the front of the galvanometer cover plate, Fig. 73.

Several key parts are now visible on the top of the camera. The GALVANOMETER for the exposure meter is under the brass cover plate near the center of the camera, Fig. 73. The exposure meter control assembly -- including the CdS cell and the two calibration pots -- is covered by transparent tape at the right-hand end of the camera.

NOTE: "Galvanometer" and "pots" are other terms you'll hear more about later in your course. The galvanometer is the part that measures the current coming from the CdS cell. The amount of current passed by the CdS cell, established by the light intensity, moves the galvanometer needle accordingly. But for now, you don't have to be concerned with how the galvanometer works -- your lesson on exposure meters covers the operation in detail.

"Pot" is a general term frequently used for variable resistors or potentiometers. The pots in the Rollei 35 are used for calibration. In other words, if the needle doesn't deflect the proper amount for the correct exposure, you can change

the resistance values of the two pots. You'll also cover calibration procedures later in your course. So for your future reference, figure 75 shows the positions of the pots after removing the transparent tape covering the control assembly (but it's not necessary to remove the tape when calibrating the exposure meter). And the schematic, Fig. 76, shows how the pots are connected in the circuit.

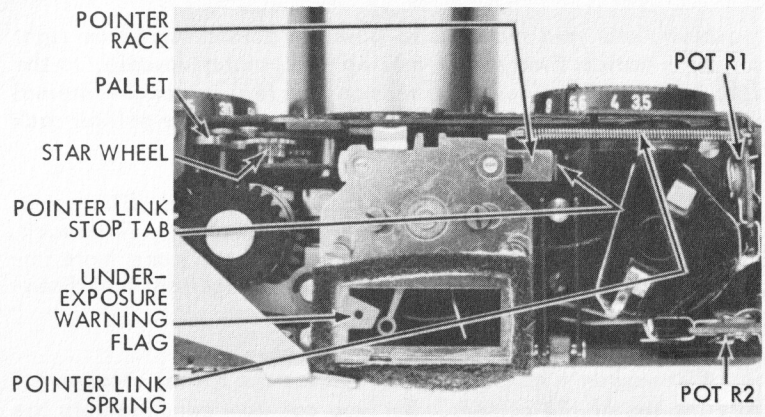


FIGURE 75

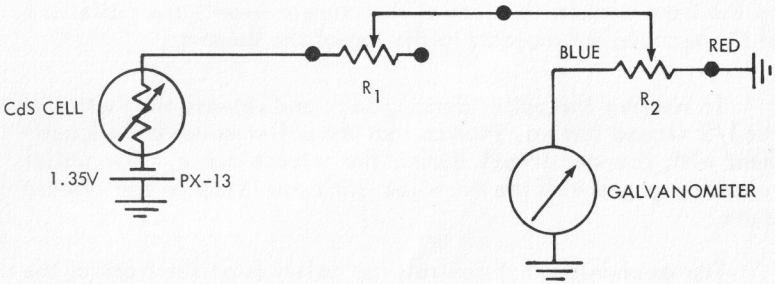


FIGURE 76

We mentioned that the shutter controls are set for the proper exposure by centering the exposure meter pointer over the exposure meter needle. The pointer is positioned by moving the speed knob, diaphragm knob, and film speed dial -- and the needle is positioned by the current from the CdS cell.

The part which controls the exposure meter pointer is the POINTER RACK, Fig. 75 (so named because a row of teeth on the pointer rack engages a gear segment on the pointer -- the gear

teeth are underneath the cover plate and are not yet visible). If you'll set your shutter speed to "bulb," your film speed to ASA 1600, and your f/stop to f/3.5 -- the combination of settings for maximum exposure -- the pointer rack moves all the way to the right in figure 75. The pointer then moves underneath the underexposure warning flag at the left end of the exposure meter window.

Now, use your tweezers to push the pointer rack from right to left -- notice that you're moving the pointer upscale, to the right in figure 75. The spring tension you feel is from an internal spring on the pointer -- the spring tends to hold the pointer rack to the right in figure 75.

In a moment, you'll see how the shutter speed, film speed, and diaphragm controls determine the position of the pointer rack. But before we move away from figure 75, there's one more important action we should point out: the engagement and disengagement of the pallet with the star wheel.

You wouldn't normally expect to see the speeds escapement from the top of the camera. But you can now examine both the star wheel and the pallet, just in front of the intermediate wind gear in figure 75. The speeds escapement is actually mounted on the front mechanism plate of the camera -- only the pallet end of the escapement projects to the top of the camera.

To observe the pallet action, cock and release the shutter at the 1/2 second setting. Notice that the pallet moves into engagement with the star wheel during the release cycle. The pallet remains engaged with the star wheel until you let up on the release plate.

The mechanism that controls the pallet is on the front of the camera, Fig. 77. The long horizontal link you can see in figure 77 is the PALLET ENGAGING LEVER. Notice that a tab on the pallet engaging lever sits on top of the release plate -- when the release button pushes the release plate down, the pallet engaging lever also moves down.

But the pallet engaging lever doesn't move down under its own power -- instead, it is pushed down by the PALLET CONTROL LEVER, the spring-loaded lever that carries the pallet, Fig. 77. During the release cycle, the pallet control lever moves from right to left -- as seen in figure 77 -- and brings the pallet into engagement with the star wheel.

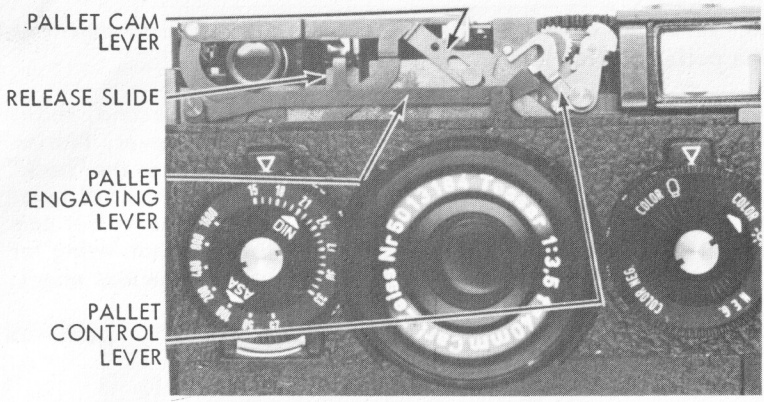


FIGURE 77 SHUTTER SET TO 1/2 SECOND

When you let up on the release button, the release plate is pushed up by the spring-loaded RELEASE SLIDE, Fig. 77 -- the release slide is the part that actually disengages the inner release lever, a function you examined earlier. Then, the release plate pulls the pallet engaging lever up, pushing the pallet control lever away from the star wheel.

> NOTE: Here is an important reference for reassembly that you should be fully aware of at this time: the release plate sits between the release slide and the tab on the pallet engaging lever. If you remove the front mechanism plate, as we'll be doing a little later, you must reposition the three parts as shown in figure 77 -- because the release plate remains with the camera body, while the release slide and the pallet engaging lever are on the front mechanism plate.

The pallet engages the star wheel only at the slow speeds -- 1/2 second through 1/15 second. At the faster speeds -- 1/30 second through 1/500 second -- the PALLET CAM LEVER, Fig. 77, prevents the pallet control lever from moving toward the star wheel.

In figure 77, the shutter is set to 1/2 second -- notice that the "hooked" end of the pallet control lever is over the cutout in the pallet cam lever. As the pallet control lever swings toward the star wheel, this "hook" drops into the cutout.

Now, turn the speed knob to the faster speeds. The pallet cam lever moves down, toward the speed knob, each time you set a faster speed. And when you reach 1/30 second, the pallet

cam lever has moved down far enough to block the movement of the pallet control lever.

Figure 78, with the speed knob set to 1/60 second, shows how the pallet cam lever blocks the pallet control lever. Notice that the raised "hump" on the pallet cam lever now faces the "hook" on the pallet control lever -- so when the pallet control lever swings toward the star wheel, its "hook" strikes the pallet cam lever. Consequently, the pallet control lever cannot swing far enough to bring the pallet into engagement with the star wheel.

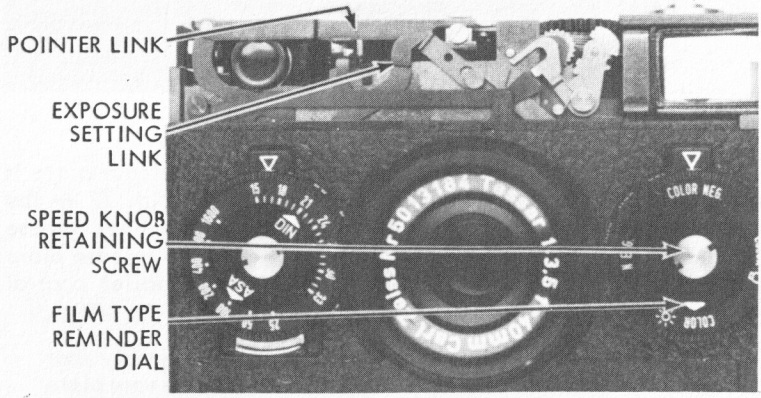


FIGURE 78 SHUTTER SET TO 1/60 SECOND

The pallet cam lever plays another vital role in the shutter -- it provides the link between the speed knob and the exposure meter pointer. You already know that changing the shutter speed moves the pointer over the exposure meter needle -- the shutter speed setting is relayed to the pointer by the pallet cam lever.

Notice that the visible end of the pallet cam lever butts against the end of another lever on the front mechanism plate. The lever resting against the end of the pallet cam lever is the EXPOSURE SETTING LINK, Fig. 78 -- the exposure setting link is part of the pointer coupling linkage.

You have seen how the pallet cam lever moves in or out when you change the shutter speeds (the pallet cam lever actually rides against a cam underneath the speed knob, a cam you'll see later in the disassembly). Turning the speed knob to the slower speeds pushes the pallet cam lever toward the top of the camera. In turn, the pallet cam lever pushes the exposure setting link in the same direction.

Simulate the action using your tweezers. With the speed knob set at a fast speed -- say 1/500 second -- push the exposure setting link from right to left, as seen in figure 78. The exposure setting link now moves the long, horizontal POINTER LINK, Fig. 78, from right to left.

The position of the pointer link is what determines how far the pointer rack can move (toward the CdS cell in figure 75) -- remember, we noted earlier how the pointer rack controls the pointer. An upturned tab on the pointer link bears against the right-hand end of the pointer rack, as seen in figure 75. So the internal spring (on the pointer) moves the pointer rack toward the CdS cell -- until the pointer rack is stopped by the upturned tab on the pointer link.

The long, tension-type spring on the pointer link, Fig. 75, pushes the pointer link stop tab against the end of the pointer rack. When you set the shutter to a faster speed, the exposure setting link follows the downward travel of the pallet cam lever -- the pointer link spring then pulls the pointer link from right to left, as seen in figure 75. As the pointer link moves from right to left, it pushes the pointer rack against the spring tension of the pointer -- and the pointer moves away from the underexposure warning flag.

While the linkage route from the speed knob to the pointer may at first sound complicated, it's really pretty straightforward: from the speed knob to the pallet cam lever; from the pallet cam lever to the exposure setting link; from the exposure setting link to the pointer link; from the pointer link to the pointer rack; and from the pointer rack to the pointer.

The action from the film speed and diaphragm settings is relayed along practically the same route. Turn the diaphragm knob (or the film speed dial) and notice how the exposure setting link and the pointer link move -- but now it's the bottom end, rather than the top end, of the exposure setting link that's moving.

Although you can't as yet see what is actuating the exposure setting link, you can visualize what is happening under the front plate. The lower (as yet hidden) end of the exposure setting link traces against a cam underneath the diaphragm knob. The exposure setting link pivots near its center -- changing the shutter speed moves one end of the exposure setting link, as you have just seen; and changing the f/stop or film speed moves the other end. But you'll have to remove the front plate to see the rest of the coupling linkage.

REMOVING THE FRONT PLATE IN THE ROLLEI 35

We must remove both the speed knob and the diaphragm knob to take off the front plate. First, unscrew the speed knob retaining screw, Fig. 78, and lift off the film type reminder dial.

CAUTION: There are spring washers sitting between the screw and the film type reminder dial -- depending on the model, there may also be a washer under the film type reminder dial. During your disassembly of both the speed knob and the diaphragm knob, be on the lookout for the washers. Note the positions of the washers and keep them in order for reassembly.

Next, lift off the speed knob.

REASSEMBLY: Replace the speed knob with its rectangular slot over the tab on the SPEED SELECTOR -- the speed selector is the part you can now see in figure 79. A row of notches around the outer edge of the speed selector receives the SPEED SELECTOR DETENT, Fig. 79, for the "click-stop" shutter speed settings.

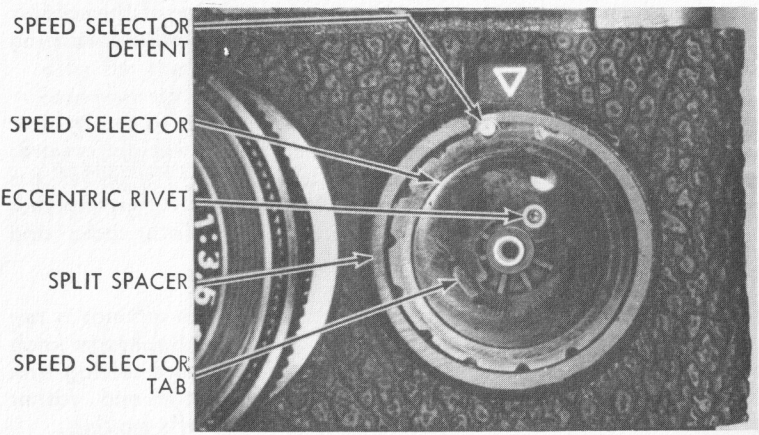


FIGURE 79

Continuing with the disassembly, lift out the split spacer that fits around the outer edge of the speed selector, Fig. 79. Notice that the shoulder on the split spacer goes down, while the opening fits over the speed selector detent.

NOTE: Early models of the Rollei 35 have what appears to be a screw on the front of the speed selector -- at the location of the rivet in later models, Fig. 79. This screw-

slotted stud is actually the end of an eccentric adjustment for the shutter speeds. Newer versions moved the screw-slotted end of the eccentric behind the speed selector, as you'll see later in the disassembly. In its new location, the eccentric looks less like a screw -- so the inexperienced technician isn't tempted to turn the eccentric during disassembly. We'll describe the shutter speed timing adjustments as we proceed.

Again looking out for washers, remove the screw holding the film speed setting dial, Fig. 80. Lift off the film speed setting dial and note the teeth on its underside (in the newer Rollei 35 models only) -- these teeth engage the corresponding teeth inside the diaphragm knob, Fig. 81. The "clicking" you hear while changing the film speed results from the teeth on the film speed setting dial sliding over the teeth on the diaphragm knob.

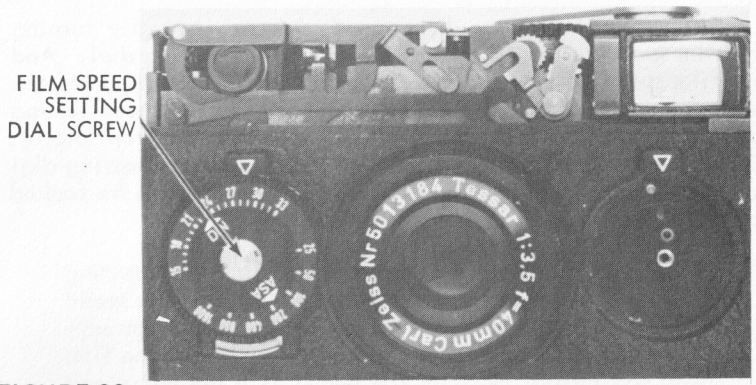


FIGURE 80

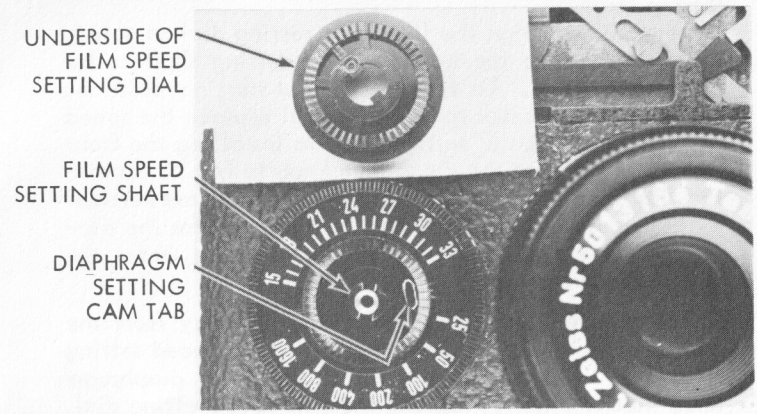


FIGURE 81

The tab passing through the diaphragm knob in figure 81 is on the DIAPHRAGM SETTING CAM, the cam which actually sets the f/stop. As yet, the tab is the only part of the diaphragm setting cam you can see -- the tab serves to couple the diaphragm setting cam to the diaphragm knob.

In addition, the tab on the diaphragm setting cam acts as a limiting stop for the film speed setting dial. The long track in the bottom of the film speed setting dial, Fig. 81, fits over the tab on the diaphragm setting cam.

Still looking at figure 81, locate the two tabs on the inner circumference of the hole through the film speed setting dial -- these two tabs fit over the slots in the FILM SPEED SETTING SHAFT. Notice that the film speed setting shaft passes through the center of the diaphragm knob.

When you select the film speed, you are actually turning the film speed setting shaft via the film speed setting dial. And the film speed setting shaft sets the initial relationship between two cams -- the diaphragm setting cam and the film speed setting cam (you'll see how these cams work after we pull the front plate). Thereafter, the diaphragm knob and the film speed setting dial turn as one unit when you select the f/stop -- both parts are locked together because of their matching teeth, Fig. 81.

REASSEMBLY: When you replace the film speed setting dial, the long track (on the underside of the film speed setting dial) must fit over the tab on the diaphragm setting cam. Also, the two tabs on the inside of the film speed setting dial key over the two slots in the film speed setting shaft.
But even if you align the film speed setting dial as noted, it's still possible for the film speed setting shaft to be 180° out of time. To find the correct starting position, set the speed selector to "bulb" (you'll replace the speed selector at the "bulb" setting prior to installing the front plate). Then, set the diaphragm knob to f/3.5. Rotate the film speed setting shaft until its two slots are vertical -- that is, until one slot points to the index for the diaphragm knob. The pointer should now be under the underexposure warning flag.

If the pointer stands a slight distance away from the underexposure warning flag, rotate the film speed setting shaft 180° -- until the other slot faces the diaphragm knob index. Finally, replace the film speed setting dial, with the ASA index pointing to ASA 1600.

Next, lift off the diaphragm knob and the large washer that sits underneath the diaphragm knob.

REASSEMBLY: There's no timing to worry about on the diaphragm knob. On reassembly, just fit the rectangular slot in the diaphragm knob over the tab on the diaphragm setting cam -- remember, the diaphragm knob turns the diaphragm setting cam via this tab.

You can now see the top of the diaphragm setting cam and the rest of the diaphragm locking lever, Fig. 82. The spring for the diaphragm locking lever is on the inside of the front plate -- and, with the diaphragm knob removed, the spring may push the diaphragm locking lever out of position. But in figure 82 you can see how the diaphragm locking lever engages the teeth on the outside edge of the diaphragm setting cam -- that's how the diaphragm locking lever holds the diaphragm setting cam at the selected aperture.

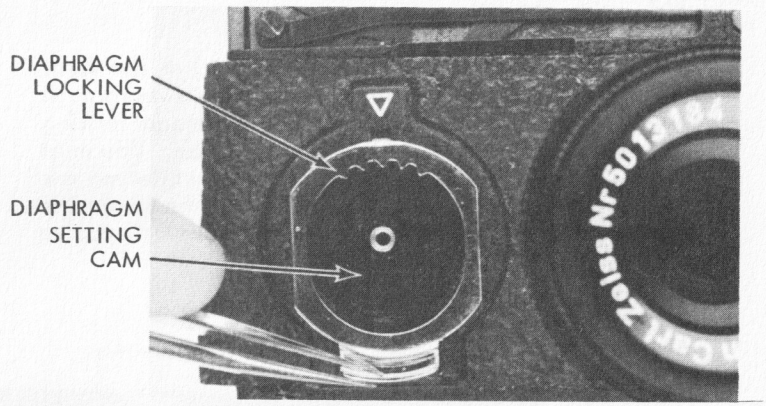


FIGURE 82

Four screws still hold the front plate to the camera body. To reach the screws, carefully peel back the leatherette at each end of the front plate. Then, remove the four screws shown in figure 83.

Now, lift off the front plate -- you must tilt the front plate during removal to clear the front lens assembly. The diaphragm locking lever is completely loose once you lift the front plate from the camera body.

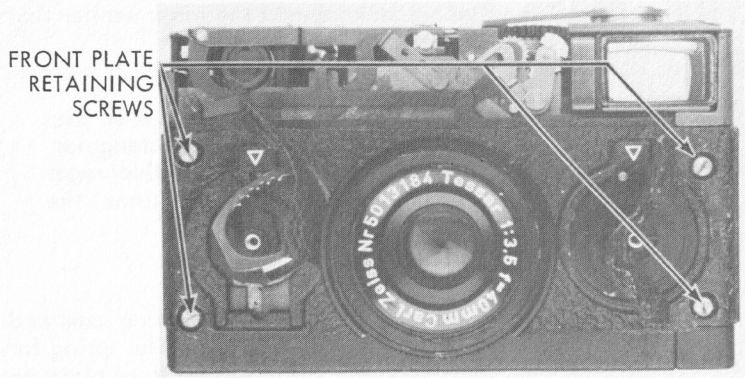


FIGURE 83

REASSEMBLY: To replace the front plate, you must first install the diaphragm locking lever and hook the diaphragm locking lever spring. The tab on top of the diaphragm locking lever passes through the rectangular slot in the front plate, Fig. 84 -- and the body of the diaphragm locking lever sits to the outside of the front plate, as you can see in figure 82.

Working from the outside (leatherette-side) of the front plate, insert the tab on the diaphragm locking lever through the rectangular slot. Then, hook the diaphragm locking lever spring, Fig. 84, to the notch in the tab. You must hold the diaphragm locking lever in place while you are installing the front plate -- continue holding the diaphragm locking lever against its spring tension until you've replaced the diaphragm knob.

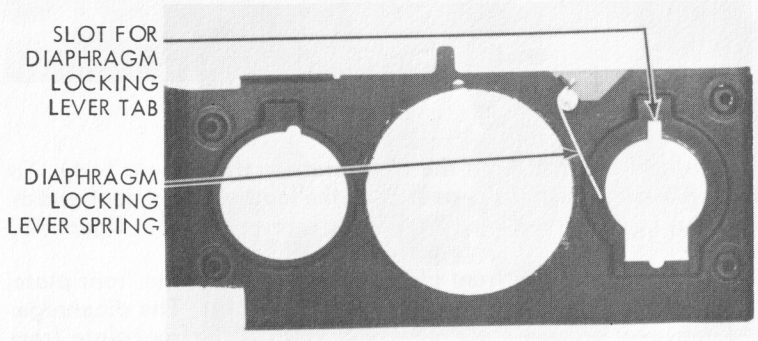


FIGURE 84 INSIDE OF FRONT PLATE

SHUTTER SPEED AND DIAPHRAGM CONTROL IN THE ROLLEI 35

Looking at the camera body, Fig. 85, you can now see the diaphragm setting cam, the speed selector, and the remaining linkage to the exposure meter pointer. The DIAPHRAGM SLIDE PLATE rides against the cam-shaped edge of the diaphragm setting cam. Turn the diaphragm setting cam in a clockwise direction and notice how the diaphragm slide plate is pushed down -- toward the bottom of the camera. The downward movement of the diaphragm slide plate opens the diaphragm in the lens -- against the tension of the diaphragm control ring spring.

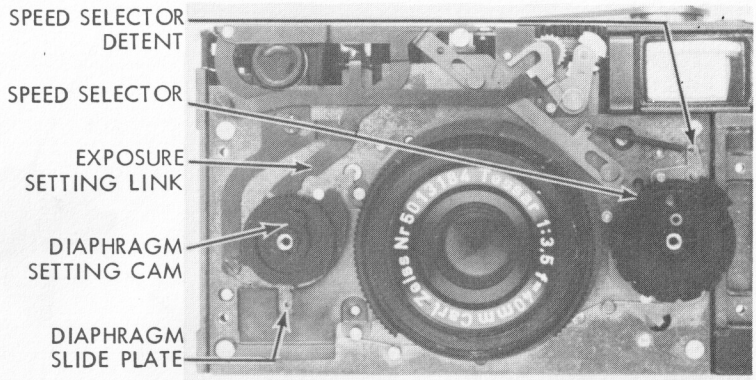


FIGURE 85

The FILM SPEED SETTING CAM, part of the film speed setting shaft, is directly underneath the diaphragm setting cam. And the lower end of the exposure setting link -- the end passing under the diaphragm setting cam in figure 85 -- rides against the film speed setting cam. When you change either the film speed setting or the diaphragm setting, you're moving the lower end of the exposure setting link through the film speed setting cam -- a movement which is transferred to the pointer via the same linkage you studied earlier.

Although the film speed setting cam and the diaphragm setting cam are separate parts, they are locked together (by the film speed setting dial) when you select the f/stop. So turning the diaphragm knob rotates both cams -- the diaphragm setting cam then sets the f/stop while the film speed setting cam moves the exposure setting link.

But turning just the film speed setting dial moves the film speed setting cam independently of the diaphragm setting cam. The diaphragm setting cam, locked in place by the diaphragm locking lever, remains stationary as you select the film speed. Consequently, selecting the film speed establishes the initial relationship between the two cams -- that is, the film speed setting cam is in the proper position with respect to the diaphragm setting cam to compensate for the particular film speed.

Now, lift off the two cams as one assembly. Figure 86 shows the diaphragm setting cam and the film speed setting cam separated. Note the long shaft on the film speed setting cam (the film speed setting shaft) and the washers which fit over the shaft between the two cams.

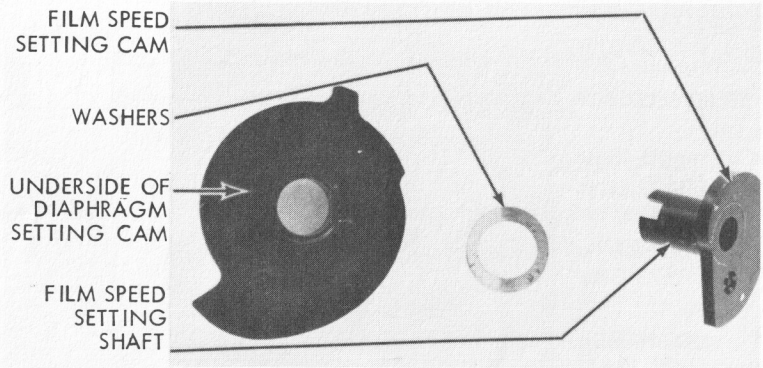


FIGURE 86

REASSEMBLY: Replace the diaphragm setting cam and the film speed setting cam as one unit. As you seat the two cams over the post on the front mechanism plate, push the lower end of the exposure setting link away from the film speed setting cam (just to make sure the exposure setting link rides on the outer edge of the film speed setting cam). Then, insert your closed tweezers into the hole provided in the diaphragm slide plate -- pull the diaphragm slide plate down, against its spring tension, until it rides against the outer edge of the diaphragm setting cam.

The next part we'll remove is the speed selector. Notice in figure 85 that one spring serves both the speed selector detent and the pallet cam lever. Figure 85 shows the shutter set to "bulb" -- the speed selector is turned all the way counterclockwise, until its stop tab is against the stop pin on the speed selector detent.

With the shutter set to "bulb," lift the speed selector straight up from its post on the front mechanism plate. The speed selector detent now swings out of position, as shown in figure 87.

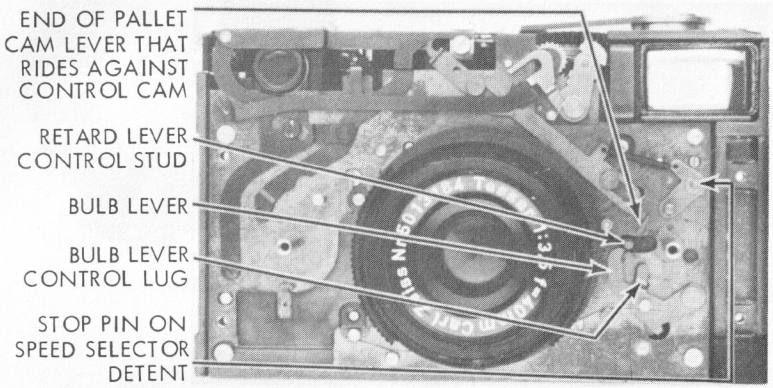


FIGURE 87

REASSEMBLY: To replace the speed selector, again use the "bulb" setting (you'll see why a little later). Orient the speed selector with the left-hand side of its stop tab adjacent to the stop pin on the speed selector detent, Fig. 87. Now, while lowering the speed selector into position, pull the speed selector detent against its spring tension -- until the pin on the speed selector detent seats in the "bulb" notch in the outer edge of the speed selector. Next, pull the pallet cam lever toward the top of the camera and seat the speed selector fully. Holding the pallet cam lever up positions the lower end of the pallet cam lever, Fig. 87, to the outside of the CONTROL CAM on the back of the speed selector, Fig. 88. The control cam is the part that moves the pallet cam lever up (or lets it move down) as you change the shutter speeds. Check your assembly by rotating the speed selector -- the pallet cam lever should move up or down as you change shutter speeds. If the pallet cam lever doesn't move, it's riding on the inside (rather than the outside) of the control cam.

There are actually three separate cams on the bottom of the speed selector. The CONTROL CAM, which we mentioned earlier, moves the pallet cam lever as you change shutter speeds. The SPEED CAM is a separate, metal part which fits over a stud on the speed selector. And the BULB CAM, visible in figure 89 after removing the speed cam, is molded on the back surface of the speed selector (as is the control cam).

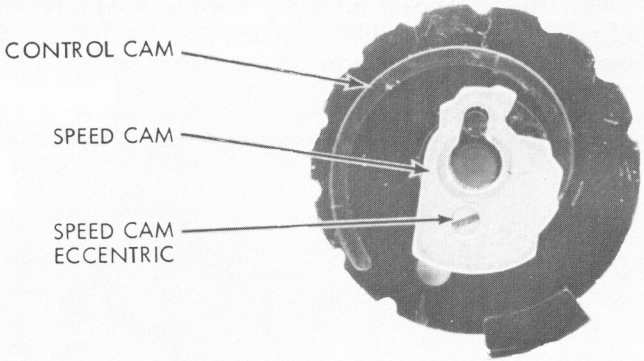


FIGURE 88 UNDERSIDE OF SPEED SELECTOR
SPEED CAM IN PLACE

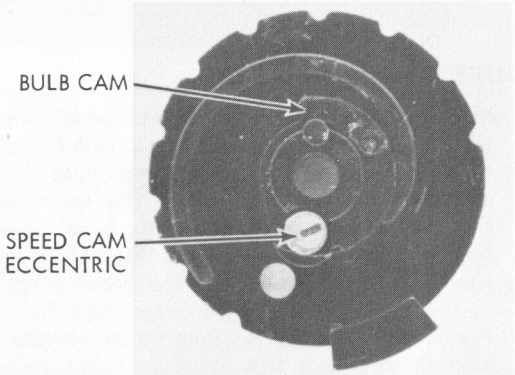


FIGURE 89 UNDERSIDE OF SPEED SELECTOR
SPEED CAM REMOVED

The speed cam controls the amount of retard engagement for the various shutter speeds. You can see the retard lever control stud in figure 87 -- the control stud passes through the front mechanism plate and rides against the outer edge of the speed cam.

We can now examine the purpose of the speed cam eccentric, Fig. 88, that we mentioned previously (in earlier models, the speed cam eccentric is on the speed cam rather than on the speed selector). Turning the eccentric swings the entire speed cam -- and thereby varies the amount of retard. As we'll describe when we get to the shutter speed adjustments, you'll turn the speed cam eccentric to adjust 1/15 second (the fastest shutter speed with the pallet engaged).

The third cam on the speed selector -- the bulb cam -- determines whether the bulb lever is engaged or disengaged. With the speed selector removed, the shutter delivers only "bulb" operation. You can see how the bulb lever works from the front of the camera -- release the shutter and notice how the end of the bulb lever, Fig. 87, moves up to grab the retard lever control stud. The bulb lever thus restrains the retard lever, holding the blades open until you let up on the release plate. Then, the inner release lever (on the other side of the front mechanism plate) pulls the bulb lever out of engagement and allows the blades to close.

Normally, the bulb lever control lug, Fig. 87, passes underneath the speed cam and rides against the bulb cam, Fig. 89. That's why we use the "bulb" setting for removing and replacing the speed selector -- at "bulb," the bulb lever control lug clears the speed cam. If you remove the speed selector at some other setting, the bulb lever control lug will catch on the speed cam -- the speed cam may then be pulled off the speed selector.

> NOTE: If you do accidentally pull the speed cam off the speed selector -- or if you remove the speed cam for other reasons -- be careful to replace the speed cam right side up. Refer to figure 88 for the proper speed cam position.

REMOVING THE FRONT MECHANISM PLATE IN THE ROLLEI 35

Most of the shutter mechanism is mounted on the back side of the front mechanism plate. To remove the front mechanism plate, first disconnect the pointer link spring from the pointer

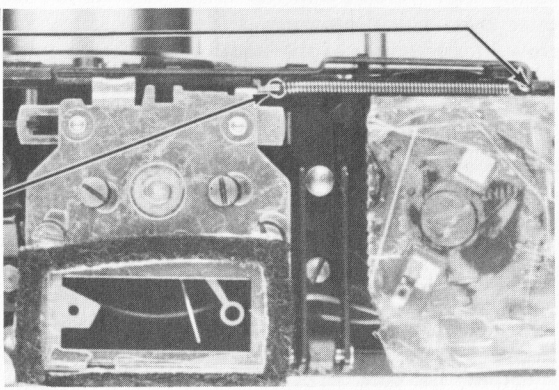


FIGURE 90

link, Fig. 90. Then, disconnect the other end of the pointer link spring (from the lug on the galvanometer cover plate) and remove the spring from the camera. The reason we are removing the pointer link spring is that the pointer link comes off with the front mechanism plate -- while the galvanometer cover plate remains with the camera body.

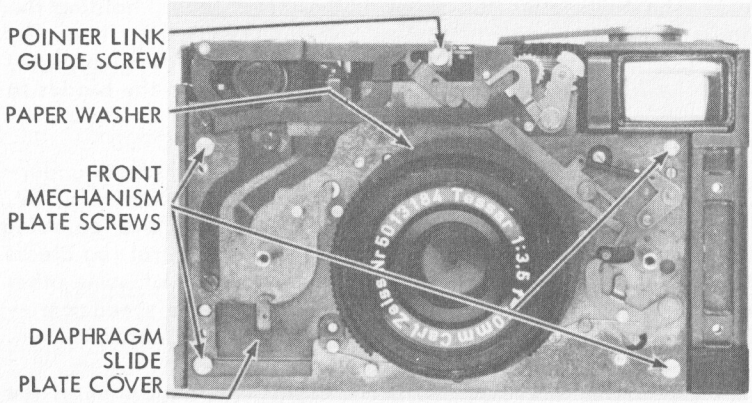


FIGURE 91

If you're going to clean the shutter mechanism using cleaning solutions, be sure to lift off the paper washer around the lens mounting ring, Fig. 91 -- just to prevent damage. Now, remove the brass shoulder screw, also pointed out in figure 91, which guides the forked end of the pointer link.

There are just four screws holding the front mechanism plate. Notice that the screw in the lower left-hand corner also holds the cover over the diaphragm slide plate, Fig. 91 -- and that the screw in the upper right-hand corner has a smaller head than do the other three.

Remove the screw in the lower left-hand corner, Fig. 91, and lift off the cover for the diaphragm slide plate. Then, take out the remaining three screws and lift off the complete front mechanism plate.

CAUTION: There may be loose shims remaining in the camera body -- the positions of these shims, when present, are pointed out in figure 92. If your camera has these shims, be sure to note the proper positions -- then, lift out the shims to prevent loss.

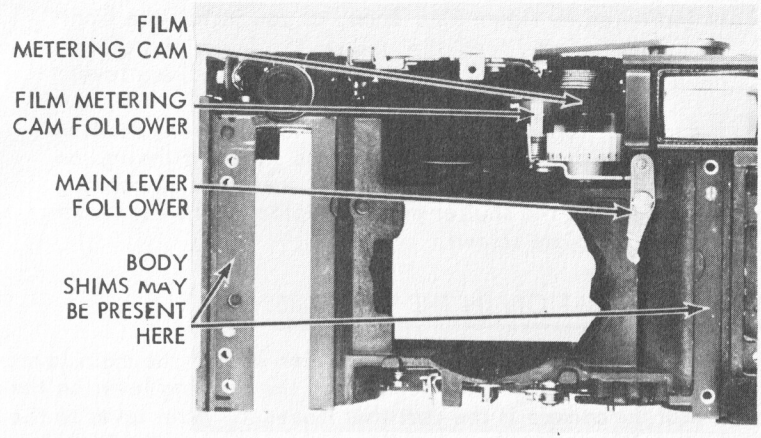


FIGURE 92

Figure 92 also shows the MAIN LEVER FOLLOWER remaining in the camera body. The tab on the main lever follower normally hooks against the side of the main lever in the shutter (now seen from the back of the front mechanism plate in figure 93). Once you cock the shutter, you cannot advance the wind lever a second time -- the reason is that the main lever follower is linked to the FILM METERING CAM FOLLOWER which engages the FILM METERING CAM.

When you release the shutter, the main lever strikes the main lever follower to disengage the film metering cam follower. So you can then advance the wind lever to cock the shutter for the next exposure.

NOTE: The parts just described make up the film metering mechanism. But since film metering mechanisms are the subject of a later lesson, we won't go further into the camera body at this time.

REASSEMBLY: When replacing the front mechanism plate, both the shutter and the cocking mechanism (in the camera body) should be in the fully-released position. Release the shutter by pushing down the RELEASE SLIDE, Fig. 93. The cocking lever in the camera body should be positioned as shown in figure 62 -- if it isn't, just advance the wind lever until the cocking cam rotates far enough to free the cocking lever.

If you found shims on the camera body, replace the shims

as indicated in figure 92. Then, as you install the front mechanism plate, feed the stud on the lower end of the main lever, Fig. 93, through the fork on the cocking lever.

Before the front mechanism plate is fully seated, position the release plate between the release slide and the tab on the pallet engaging lever. Test the operation by cocking and releasing the shutter prior to replacing the four front mechanism plate screws.

SHUTTER OPERATION IN THE ROLLEI 35

To cock the shutter, pull the lower end of the main lever from left to right, Fig. 93. Remember, the cocking lever on the bottom of the camera is the part that moves the main lever to the cocked position. At the end of the cocking stroke, the inner release lever latches the lower end of the main lever, Fig. 94.

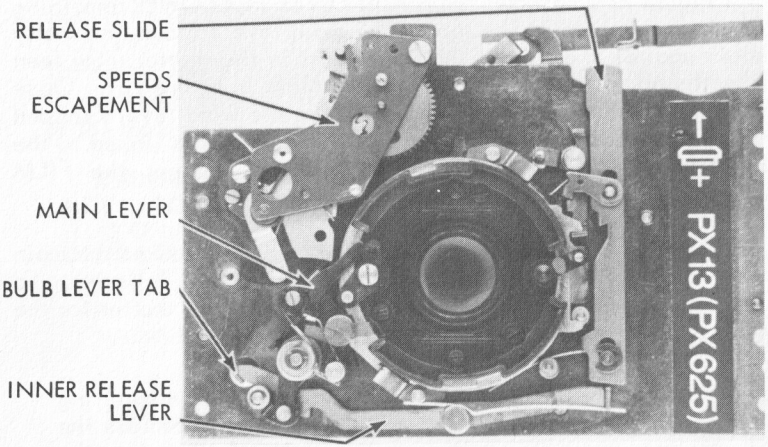


FIGURE 93 SHUTTER RELEASED

Release the shutter by pushing down on the release slide, Fig. 93. The release slide then disengages the inner release lever from the main lever. You noted earlier how the main lever drives the blades open -- and then closes the blades at the end of the release cycle.

We've already mentioned that the inner release lever disengages the bulb lever to close the shutter blades on "bulb." In figure 93, you can see a tab on the bulb lever extending through a hole in the front mechanism plate -- the end of the inner release lever sits on top of this tab. So when the spring-loaded inner

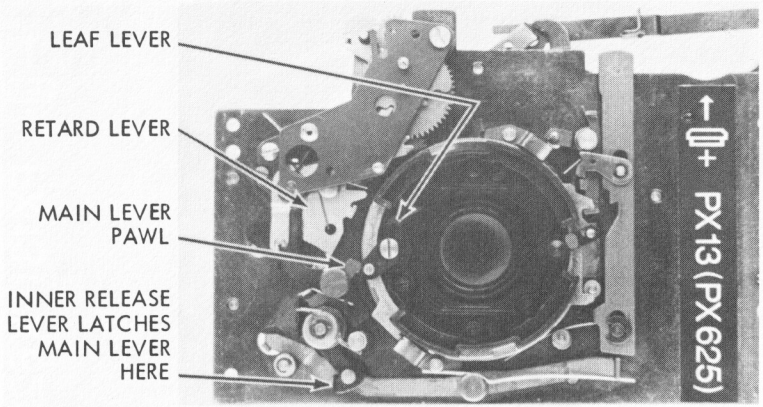


FIGURE 94 SHUTTER COCKED

release lever returns to its rest position, it pushes the bulb lever out of engagement with the retard lever control stua.

On "bulb" -- and on all shutter speeds except 1/500 second -- the downward-projecting tab on the main lever strikes the retard lever, Fig. 94. During the release cycle, the spring-loaded pawl on the main lever grabs the leaf lever stud to open the blades -- then, the main lever is delayed by the speeds escapement to hold the blades open for the desired shutter speed.

The length of the shutter speed is determined by the depth that the retard lever engages the main lever. Setting slower speeds allows the spring-loaded retard lever to move to your left in figure 94 -- into deeper engagement with the main lever. Remember, you noted earlier how the retard lever control stud rides against the speed cam on the speed selector.

Setting faster speeds pushes the retard lever to the right -- until, at 1/500 second, the retard lever is held completely clear of the main lever. Now, the shutter speed depends only on the mainspring tension.

Other features we can now examine include the diaphragm linkage and the locking mechanism for the lens tube. The diaphragm control arm, Fig. 95, engages the diaphragm slide plate -- earlier, you examined the diaphragm slide plate from the outside of the front mechanism plate. A long rod connects the diaphragm control arm to the spring-loaded diaphragm control ring.

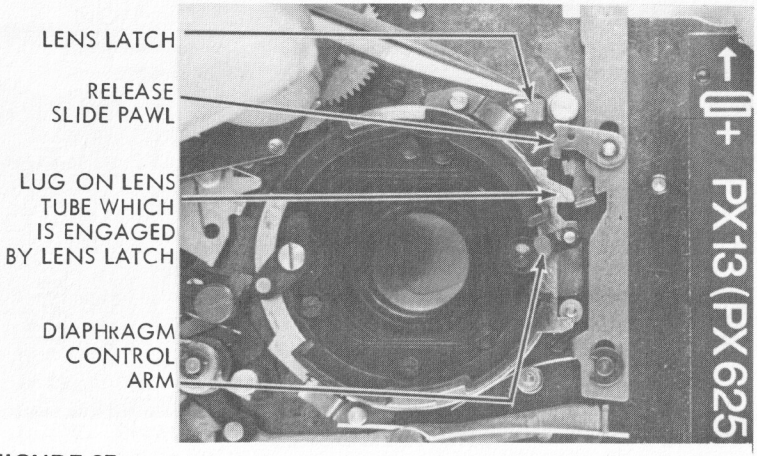


FIGURE 95

The mechanism that locks and releases the lens tube is just above the diaphragm control arm in figure 95. The LENS LATCH engages a projection on the rear of the lens tube. Normally, the forked slide (remaining with the top cover plate, Fig. 74) straddles the pin on the end of the spring-loaded lens latch.

To collapse the lens tube, first cock the shutter -- there's another latch engaging the lens tube (which you'll see after removing the main lever) that the main lever moves aside. Now, push the lens latch out of engagement with the lens tube, as shown in figure 95. Turn the lens tube slightly clockwise (as viewed from the inside of the front mechanism plate) and push the lens tube in.

Notice that the spring-loaded RELEASE SLIDE PAWL, Fig. 95, now holds the lens latch away from the lens tube. So with the lens tube collapsed, the lower end of the lens latch engages the release slide -- that's why you cannot depress the release button when the lens is in its storage position.

Return the lens to its taking position by pulling the lens tube out and turning it counterclockwise. A projection on the rear of the lens tube then kicks the release slide pawl out of engagement with the lens latch. Consequently, the lens latch moves in to engage the lens tube -- simultaneously freeing the release slide.

DISASSEMBLY OF THE ROLLEI 35 SHUTTER MECHANISM

In routine cleaning and lubrication, removing the main lever

and the speeds escapement is sufficient disassembly. The remaining shutter parts, with the exceptions of the shutter blades and diaphragm leaves, may be cleaned on the front mechanism plate. And, since the shutter blades and diaphragm leaves are well sealed within the front lens assembly, they rarely get dirty.

Before you remove the main lever, carefully note the hooking point of the mainspring -- in particular, the lower end of the mainspring. You can see in figure 96 that the main lever has two mainspring hooking notches. Either notch may be used to hook the lower end of the mainspring, depending on the amount of tension required -- or, for maximum tension, the mainspring may be hooked on the outside of the second notch.

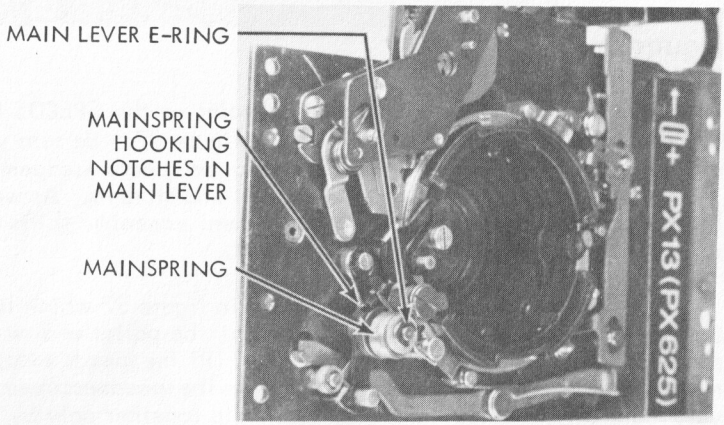


FIGURE 96

The different mainspring hooking points give you some control of the shutter speeds -- as we'll describe during the shutter speed adjustment procedures. But normally you'll hook the lower end of the mainspring in the same notch it occupied prior to disassembly.

With the shutter in the released position, disconnect the upper end of the mainspring from the brass post on the front mechanism plate. Now lift out the mainspring. Remove the E-ring over the main lever post, Fig. 96, and lift off the main lever.

You can now see the SECONDARY LATCH, Fig. 97. The secondary latch engages the lens tube when the shutter is in the released position. During the cocking cycle, the main lever pulls the secondary latch away from the lens tube -- you can then collapse the lens tube as previously described.

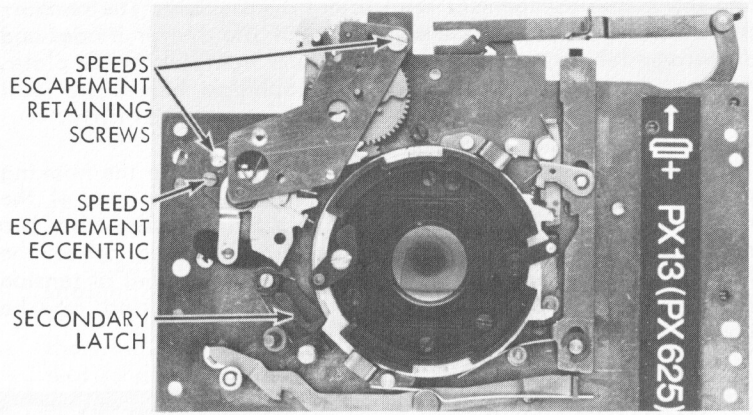


FIGURE 97

Another shutter speed adjustment point -- the SPEEDS ESCAPEMENT ECCENTRIC -- is shown in figure 97. Be sure you don't turn the eccentric while removing the speeds escapement -- that way, the adjusted position is left undisturbed. As we'll later discuss, turning the speeds escapement eccentric shifts the retard lever end of the speeds escapement.

Take out the two screws pointed out in figure 97 which hold the speeds escapement -- a long screw at the pallet end and a short screw at the retard lever end. Now, lift the speeds escapement off the front mechanism plate. Handle the speeds escapement very carefully -- once removed, it is held together only by the one screw on its underside.

NOTE: Although we'll go further in the disassembly for explanation purposes, we'll pause for a moment to discuss the present lubrication points. Before you replace the main lever, lubricate two places with moly-lube: the tab on the main lever that strikes the retard lever and the lower end of the main lever that is engaged by the inner release lever. You can also spread the mainspring slightly and brush a trace of moly-lube between the coils -- this lubrication helps bring in the fast shutter speeds. The main lever post should be lubricated with a minute hint of shutter oil.

Many technicians prefer to leave the speeds escapement perfectly dry, with no lubrication. Others lightly oil the pivot points. But using dry moly is probably the most

widely accepted method of lubricating speeds escapements. Dry moly, in powder form, works into the gear teeth and pivots -- that tends to fill the pores in the metal to produce smooth surfaces.

After rubbing the dry moly into the escapement, work the retard lever several times. Then, use an air blower to remove all of the dry moly that hasn't been worked into the metal. It's important that you remove all the excess dry moly remaining in the escapement.

REMOVING THE SHUTTER BLADES IN THE ROLLEI 35

If the shutter blades or diaphragm leaves require cleaning, you must remove the front lens assembly. It's possible to remove the complete front lens assembly without disassembling the parts on the rear lens baffle, Fig. 98 -- just take out the three mounting screws shown in figure 98. The mounting screws have long heads that slip through the holes in the rear lens baffle.

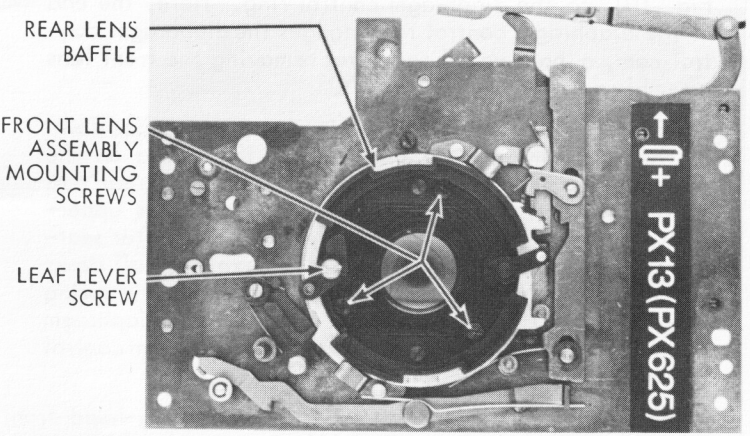


FIGURE 98

However, to better examine the remaining shutter operation, we'll remove the rear lens baffle. First, take out the leaf lever screw shown in figure 98 and lift off the leaf lever. Then, remove the collar which slips over the leaf lever shaft, Fig. 99 -- the leaf lever shaft connects the leaf lever to the blade operating ring inside the front lens assembly.

Next, remove the two small screws holding the rear lens baffle, Fig. 99. Lift off the rear lens baffle together with the diaphragm control arm.

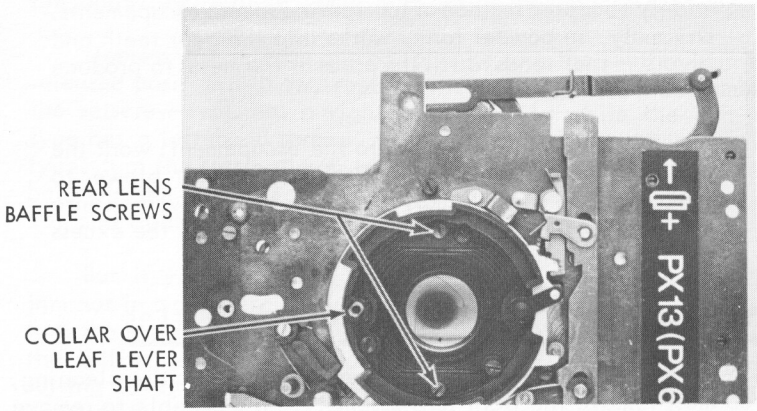


FIGURE 99

REASSEMBLY: Replace the rear lens baffle and diaphragm control arm as one unit, Fig. 100. The long diaphragm control rod feeds down through the hole in the lens tube, Fig. 101, to the diaphragm control ring. Here, the end of the diaphragm control rod engages the diaphragm control cam, a part you'll see after removing the front lens assembly.

The diaphragm leaves within the lens are now stopped down to the smallest aperture (because of the spring on the diaphragm control ring). So as you install the rear lens baffle, position the diaphragm control arm in its uppermost position -- as shown in figure 99. Then, after seating the rear lens baffle, use your tweezers to pull down the diaphragm control arm -- if you can feel the spring tension on the diaphragm control arm (from the diaphragm control ring spring), you know that the diaphragm control rod is properly engaged.

Now, you have a better view of the three long-head front lens assembly mounting screws, Fig. 101. Remove the three screws and slide out the front lens assembly toward the front of the lens tube -- CAREFUL: There's a stack of washers on the back of the front lens assembly, Fig. 102, that must be correctly positioned during reassembly.

Lift off all of the washers on the front lens assembly -- but be sure to keep the washers in proper sequence for reassembly. The diaphragm control cam, also shown in figure 102, is the part that receives the lower end of the diaphragm control rod. In a moment, you'll see how the diaphragm control cam couples to the diaphragm control ring.

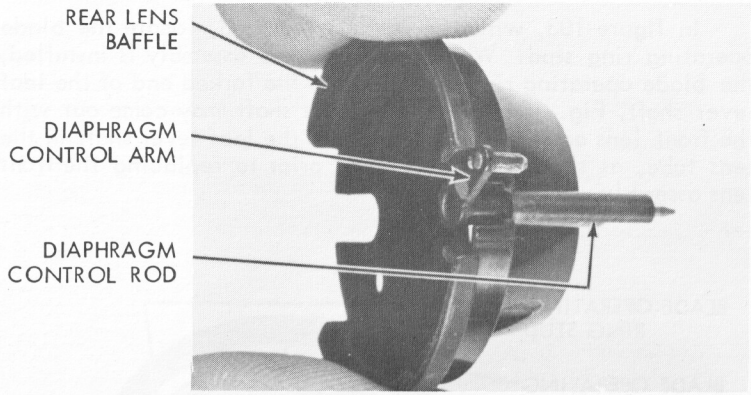


FIGURE 100

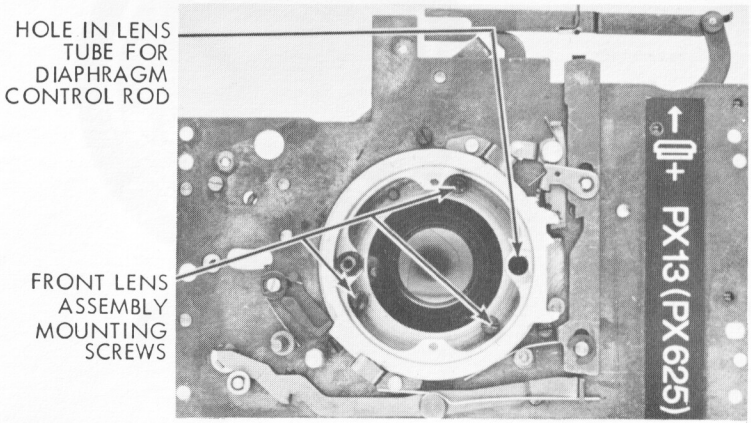


FIGURE 101

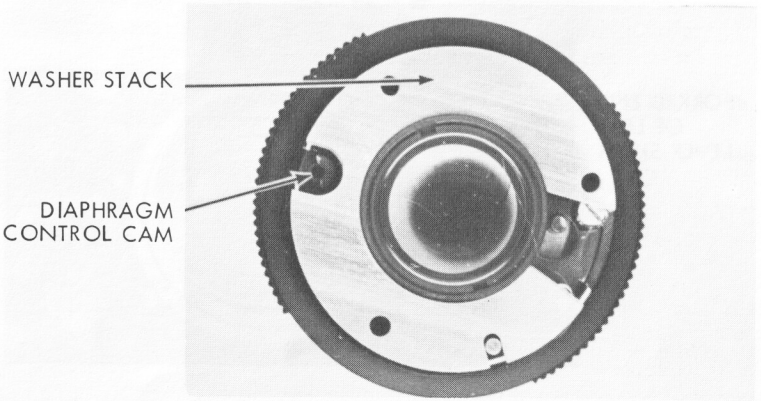


FIGURE 102

In figure 103, with the washers removed, locate the blade operating ring stud. When the front lens assembly is installed, the blade operating ring stud fits into the forked end of the leaf lever shaft, Fig. 104. The leaf lever shaft may come out with the front lens assembly -- but replace the leaf lever shaft in the lens tube, as shown in figure 104, prior to replacing the front lens assembly.

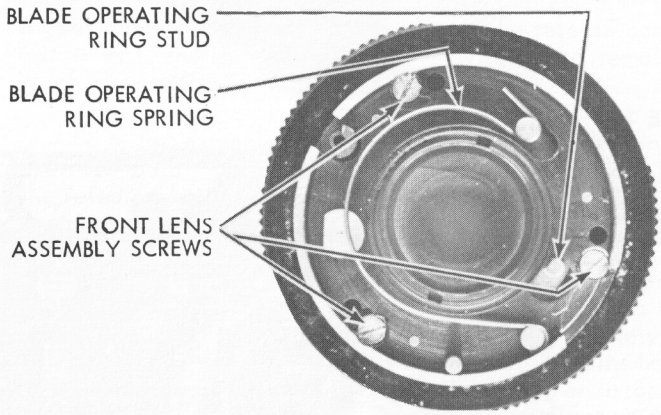


FIGURE 103

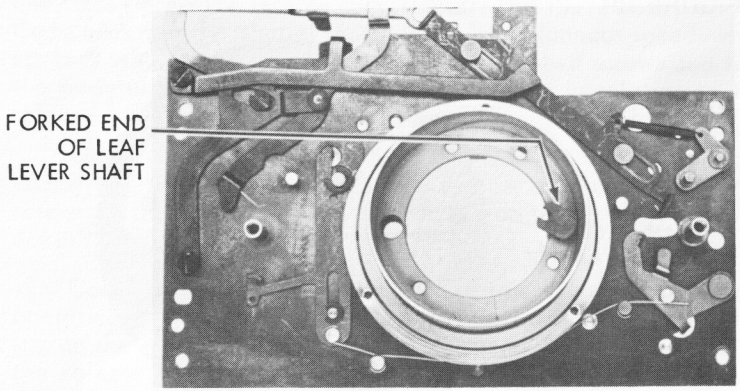


FIGURE 104

The front lens assembly houses the shutter blades and diaphragm leaves, as well as the taking lens elements. To reach the shutter blades, we must completely disassemble the front lens assembly. First, note the position of the blade operating ring spring, Fig. 103. To open the shutter blades, turn the blade operating ring in a clockwise direction -- when you let go of the blade operating ring stud, the spring returns the blades to the closed position.

Now, disconnect and remove the blade operating ring spring. Take out the three screws shown in figure 103 -- but do not as yet lift off the rear lens plate. If you do, several parts will be loose and you won't be able to examine their proper positions.

Just to see the parts positions for reassembly reference, hold the complete front lens assembly together and turn it over -- now, slide off the rear lens plate from the bottom of the assembly. The three shutter blades thus remain in place on the top of the rear lens plate, Fig. 105 (figure 105 shows the shutter blades in the open position, as you'll install them during reassembly).

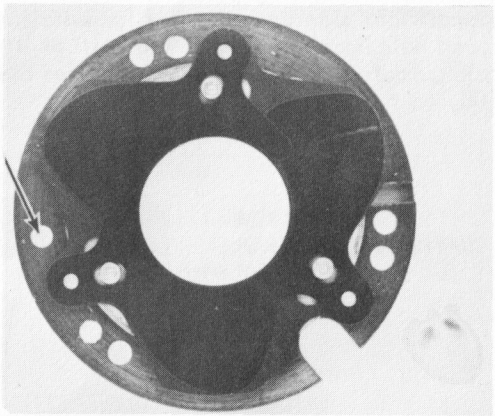


FIGURE 105 REAR LENS PLATE

Note the proper rotation and lift off the three shutter blades. The TRIANGULAR SPACER, Fig. 106, fits between the shutter blades and the blade operating ring. Notice the semicircular cutout in the triangular spacer which faces the cutout in the rear lens plate -- both cutouts provide clearance for the diaphragm control cam, Fig. 102.

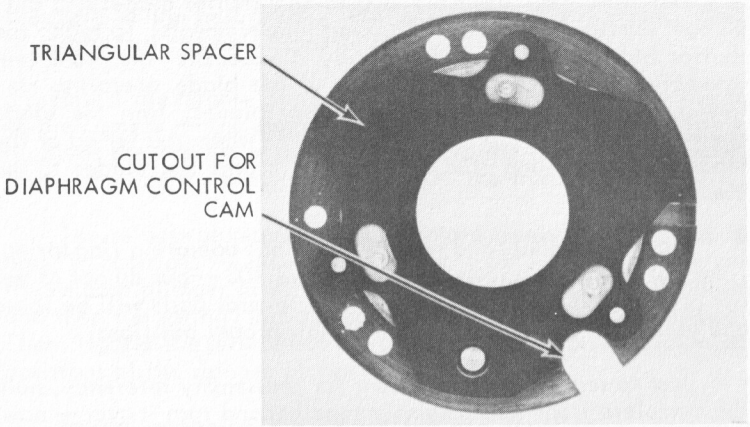


FIGURE 106

There's only one position for the triangular spacer on reassembly. Lift off the triangular spacer and examine its three outermost holes, Fig. 107. These three holes fit over the locating pins on the rear lens plate -- and the larger, oblong holes fit over the blade operating ring pins. In figure 107, with the triangular spacer right side up and ready for installation, notice the large, round hole immediately to the left of the diaphragm control cam cutout -- this round hole straddles the LIMITING PIN, Fig. 108, on the rear lens plate.

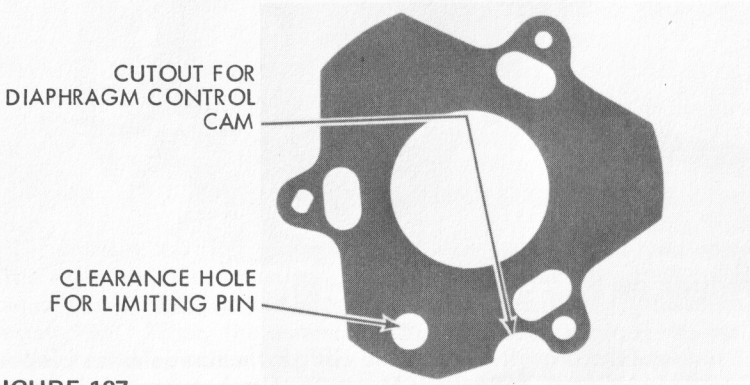


FIGURE 107

NOTE: Some Rollei 35 models do not have the limiting pin on the rear lens plate -- consequently, the triangular spacer lacks the round hole pointed out in figure 107. For

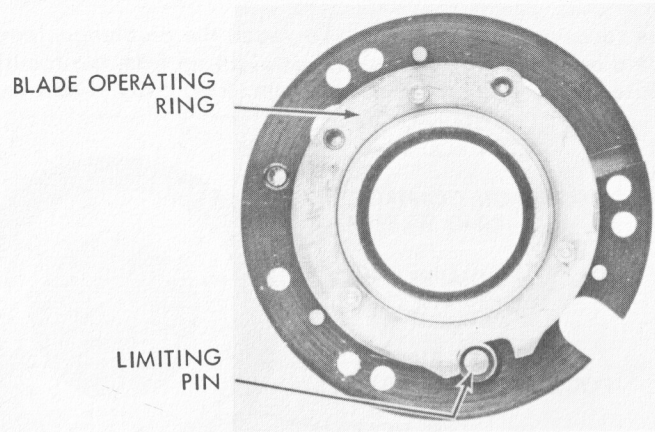


FIGURE 108

reassembly reference, locate the one outer hole in the triangular spacer which is oblong in shape -- the triangular spacer is right side up when this oblong hole is immediately to the left of the diaphragm control cam cutout.

The blade operating ring still remains on the rear lens plate, Fig. 108. A fork on the outer edge of the blade operating ring straddles the limiting pin -- so the limiting pin restricts the clockwise and counterclockwise rotations of the blade operating ring. With the blade operating ring turned as far as it can go in a counterclockwise direction, as shown in figure 108, the blades are in the full-open position. Lift off the blade operating ring to complete your disassembly of the rear lens plate.

The remaining assembly contains the diaphragm leaves and

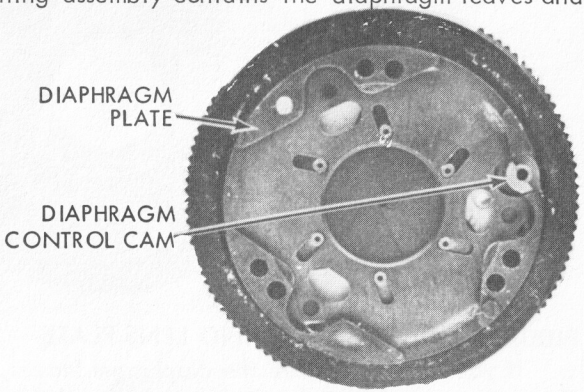


FIGURE 109

the focusing lens elements. To reach the diaphragm leaves, lift the diaphragm plate, Fig. 109, straight up from the focusing lens plate -- the diaphragm control cam, Fig. 110, is now loose.

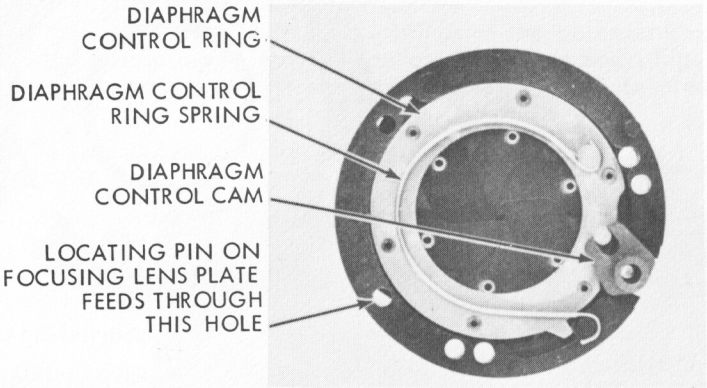


FIGURE 110

Figure 110 shows the opposite side of the diaphragm plate from figure 109 -- that is, the side that faces the focusing lens plate, Fig. 111. In figure 110, you can see how the forked diaphragm control cam straddles the stud on the spring-loaded diaphragm control ring -- remember, the diaphragm control cam is the link between the diaphragm control ring and the diaphragm control arm.

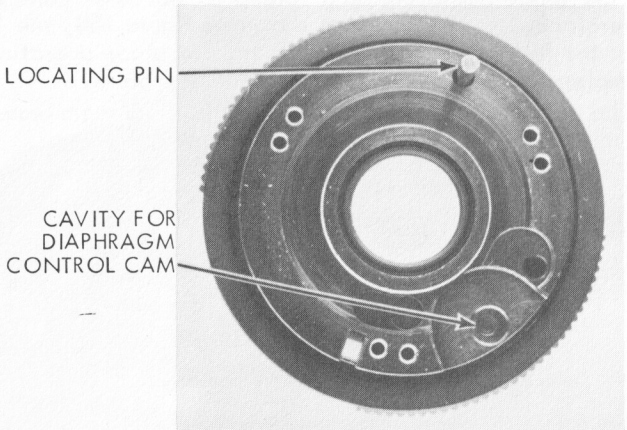


FIGURE 111 FOCUSING LENS PLATE

If you have to remove the diaphragm leaves, just disconnect the diaphragm control ring spring and lift off the diaphragm control ring. Right now, the spring is the only part that's holding the diaphragm assembly together.

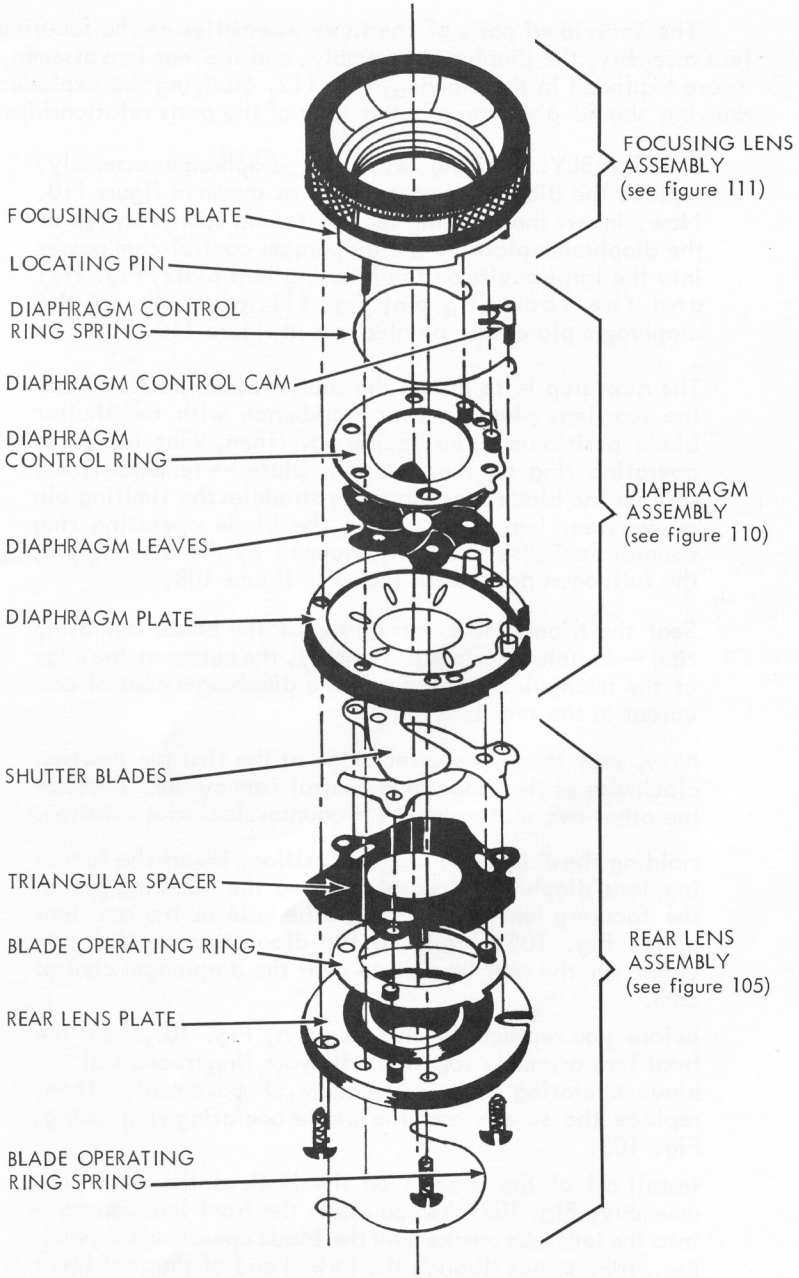


FIGURE 112 EXPLODED VIEW OF FRONT LENS ASSEMBLY

The individual parts of the three assemblies -- the focusing lens assembly, the diaphragm assembly, and the rear lens assembly --are exploded in the drawing, Fig. 112. Studying the exploded drawing should give you a better idea of the parts relationships.

REASSEMBLY: Starting with the diaphragm assembly, replace the diaphragm control cam as shown in figure 110. Now, invert the focusing lens plate and seat it on top of the diaphragm plate -- the diaphragm control cam passes into the large cavity on the focusing lens plate, Fig. 111; and the locating pin, Fig. 111, passes through the diaphragm plate hole pointed out in figure 110.

The next step is to install the shutter blade parts. Place the rear lens plate on your workbench with the shutter blade positioning pins facing up. Then, seat the blade operating ring on the rear lens plate -- remember, the fork on the blade operating ring straddles the limiting pin on the rear lens plate. Turn the blade operating ring counterclockwise until it is stopped by the limiting pin, the full-open position as shown in figure 108.

Seat the triangular spacer on top of the blade operating ring --as noted during disassembly, the cutout at the edge of the triangular spacer faces the diaphragm control cam cutout in the rear lens plate.

Now, seat the first shutter blade at the first pin position clockwise of the diaphragm control cam cutout. Replace the other two shutter blades in counterclockwise rotation.

Holding the diaphragm plate in position, invert the focusing lens/diaphragm assembly. Feed the locating pin on the focusing lens plate through the hole in the rear lens plate, Fig. 105 -- and fit the diaphragm control cam cutout in the rear lens plate over the diaphragm control cam.

Before you replace the three screws, Fig. 103, hold the front lens assembly together with your fingers and test the blade operating ring for freedom of movement. Then, replace the screws and the blade operating ring spring, Fig. 103.

Install all of the spacers on the back of the front lens assembly, Fig. 102. As you insert the front lens assembly into the lens tube, make sure the blade operating ring stud, Fig. 103, passes through the forked end of the leaf lever shaft, Fig. 104.

ADJUSTING THE SHUTTER SPEEDS IN THE ROLLEI 35

Once you've completed the reassembly of the front mechanism plate -- to the stage shown in figure 113 -- you can test and adjust the shutter speeds. You must, however, install the speed selector to set the various exposure times. Be sure to hold the pallet control lever against its spring tension as you turn the speed selector from 1/15 second to 1/30 second -- otherwise, the pallet control lever will catch the pallet cam lever.

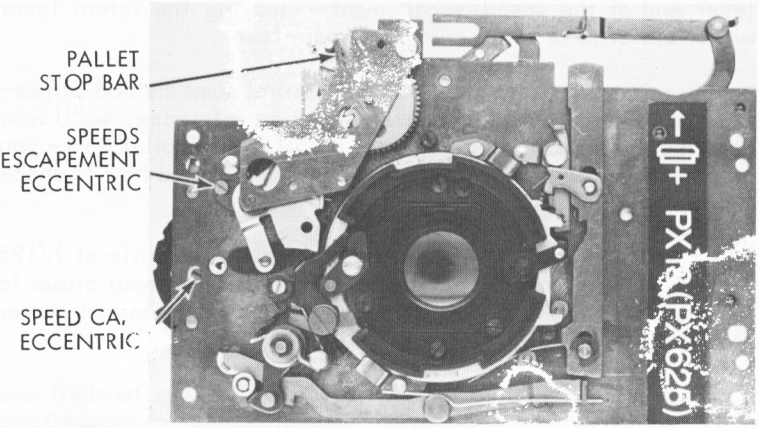


FIGURE 113 SHUTTER SET TO 1/15 SECOND

There are four shutter speed adjustment points visible from the back of the front mechanism plate -- the mainspring tension, two adjustments for the depth of retard lever engagement, and the pallet engagement.

We mentioned the mainspring adjustment earlier in the lesson. Remember, you can increase or decrease the mainspring tension -- just by changing the mainspring's hooking point on the main lever. Normally, you can assume that the original mainspring position noted during disassembly is correct. However, testing the shutter speed at 1/500 second indicates the proper tension. If necessary, you can change the mainspring hooking point to increase or decrease the mainspring tension -- and thereby increase or decrease the 1/500 second shutter speed.

Although you haven't as yet studied the methods of testing shutter speeds, you can nonetheless make a rough visual adjustment on the depth of retard lever engagement. Remember, the retard lever engages the main lever at all shutter speeds slower than 1/500 second. So we set the initial position of the speeds escapement to assure that the main lever does not engage the retard lever at the fastest speed.

The shutter should be in the released position with the speed selector still set to 1/500 second. Now, you should be able to see a fine space gap (approximately 0.05mm) between the main lever and the retard lever -- the space gap assures that the main lever cannot contact the retard lever at 1/500 second.

To obtain the space gap, loosen the two speeds escapement retaining screws and turn the speeds escapement eccentric, Fig. 113. Remember, turning the eccentric swings the entire retard lever end of the speeds escapement -- moving the retard lever either closer to or farther from the main lever.

Precise accuracy in adjustment requires some method of testing the shutter speeds. So for your future reference, we'll now describe the remaining adjustment points in the Rollei 35 -- you can put this information to use after you've learned how to check shutter speed accuracy.

Check and adjust the speeds escapement eccentric at 1/125 second. Swing the retard lever end of the escapement closer to the main lever for a slower speed, or farther from the main lever for a faster speed.

Adjusting 1/500 second (with the mainspring tension) and 1/125 second (with the speeds escapement eccentric) should bring the remaining speeds into time. You do, however, have an additional adjustment for the amount of retard if your 1/15 second is too fast or too slow -- remember, 1/15 second is the fastest shutter speed with the pallet engaged. The 1/15 second adjustment is the speed cam eccentric -- on the back of the speed selector in recent models, and on the front of the speed selector in early models.

If you're working on a recent model, reach the speed cam eccentric through the special clearance hole in the front mechanism plate -- at 1/15 second, the eccentric aligns with the clearance hole, Fig. 113. In early models, you can reach the eccentric from the front of the speed selector.

Now, if you do adjust 1/15 second with the speed cam eccentric, recheck your 1/125 second shutter speed. You may have to alternate between the two eccentrics to bring both speeds into tolerance.

There is also a "last resort" adjustment on the depth of pallet engagement -- an adjustment that affects only the pallet speeds of 1/15 second through 1/2 second. For example, say that your

speeds of 1/500 second through 1/30 second are accurate -- but you can't bring in the slow-speed range. You can then adjust the depth that the pallet engages the star wheel by reforming the PALLET STOP BAR, Fig. 113. Increasing the depth of pallet engagement effects a slower shutter speed.

ADJUSTING THE LENS FOCUS IN THE ROLLEI 35

The Rollei 35 has a front cell focusing lens -- meaning, as you'll recall, that only the front lens element turns during focusing. Adjusting a front cell focusing lens requires changing the position of the front cell relative to the lens focusing ring.

You already know how to check the focus by using a ground glass attached to the focal-plane aperture. Now, assume that the focusing scale reads infinity -- but the image of your infinity target viewed on the ground glass is out of focus. You must then turn the front lens cell separately from the lens focusing ring.

In many cameras, the front cell is held to the lens focusing ring by setscrews. Loosening the setscrews around the outer edge of the lens focusing ring frees the front cell -- which can then be turned in or out while the lens focusing ring remains at infinity. But in the Rollei 35, the screws are hidden by the front decorator ring, Fig. 114.

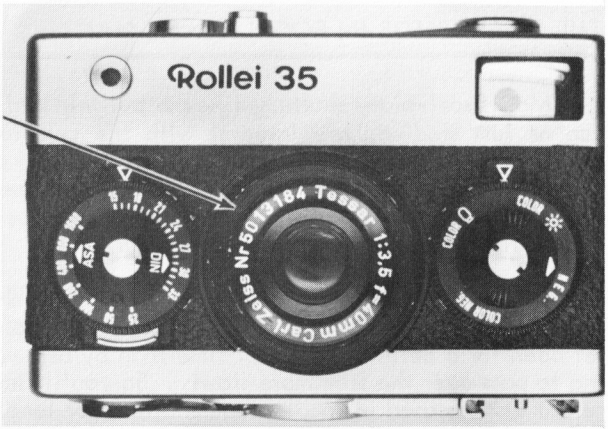


FIGURE 114

The front decorator ring is cemented in position. To adjust the focus, first locate the notch on the inner circumference of the front decorator ring -- slip a small screwdriver into the notch and carefully lift off the front decorator ring.

Removing the front decorator ring reveals three screws, Fig. 115. Set the lens focusing ring to infinity and loosen the three screws. Now, while holding the lens focusing ring at infinity, turn the front cell until the ground glass image is in sharp focus. Once you've found the correct position for the front cell, tighten the three screws and recement the front decorator ring.

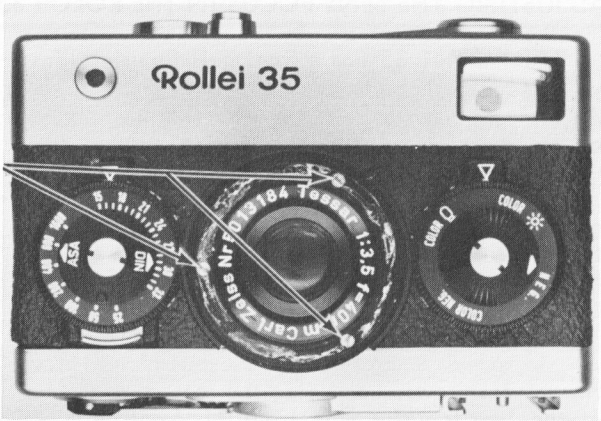


FIGURE 115

THE SLOW SPEEDS IN FOCAL-PLANE SHUTTERS

Most focal-plane shutters, like the built-in leaf-type shutters you've just studied, are integral with the camera body. And among the systems you've covered, the focal-plane shutter is most closely allied to the simple disc shutter -- remember, in the disc shutter the exposure is controlled by varying the speed of the disc and/or the size of the opening in the disc.

The same two factors apply to focal-plane shutter speeds. However, it's better to obtain long exposures by holding the shutter open for a definite period of time than by allowing the opening to pass over the film more slowly. So you'll find escapement retard systems used in focal-plane shutters for long exposures .

THE DOUBLE-ESCAPEMENT RETARD IN THE ILEX ACME SHUTTER

The Ilex Acme, Fig. 116, is a modular shutter enjoying widespread use among large-format photographers. Most significantly, the Ilex Acme provides us with one of the truly unique variations of the escapement retard in currently-produced shutters.

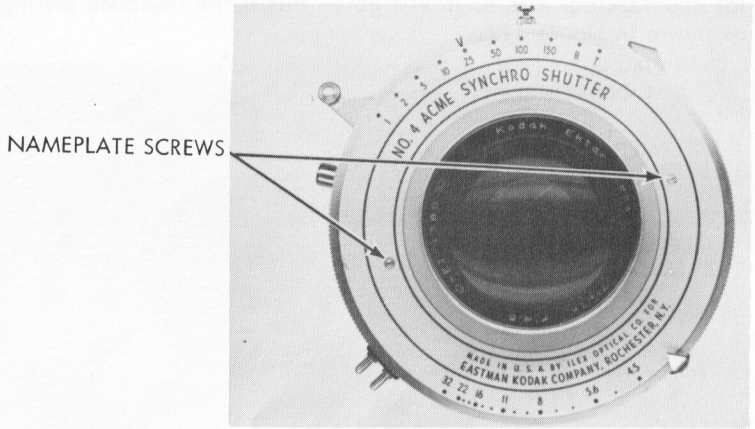


FIGURE 116

You have found that, as a rule, several retard action systems must be incorporated into a shutter for a maximum number of shutter speeds. Among the retard systems you've seen are the retard gear train, the inertia retard, variable spring tension, etc. In shutters like the Compur, Rapax, Supermatic, and Prontor, the inertia retard and the escapement gear train systems are combined by the adjustable pallet.

The Ilex Acme, on the other hand, uses neither a high-speed spring nor an adjustable pallet to obtain a wide range of shutter speeds -- yet its speed range is comparable to the ones in the shutters just mentioned.

The great range of speeds is obtained by using two separate retard sections operating in tandem. The first, offering little resistance, is large and is used on all the intermediate speeds (1/25, 1/50, and 1/100 second, as well as "time" and "bulb"). It, in turn, drives another retard section -- the second retard section is small, offers greater resistance, and is engaged at the slow-speed settings (1, 1/2, 1/5, and 1/10 second).

PARTIAL DISASSEMBLY OF THE ILEX ACME SHUTTER

Prepare the shutter for disassembly by removing the lens cells and placing them in a safe location. Two screws hold the shutter nameplate, Fig. 116. Remove the screws and lift off the nameplate.

With the speed cam now exposed, Fig. 117, you can analyze its control of the various shutter parts. Move the speed cam as far counterclockwise as it will go -- this is the 1-second setting, as shown in figure 117.

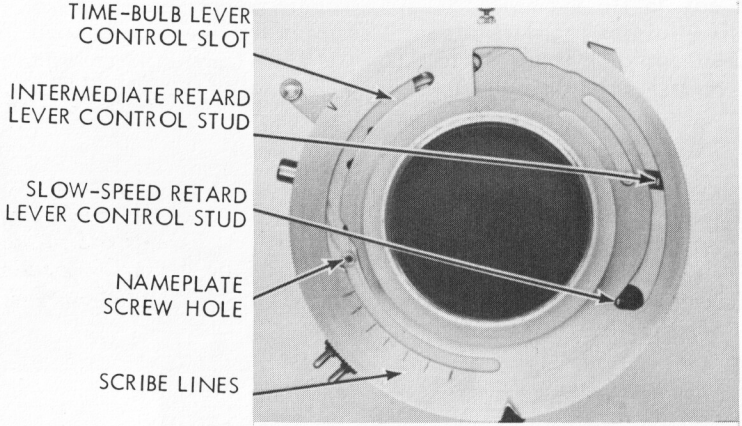


FIGURE 117 SHUTTER SET TO 1 SECOND

Notice that there are two cutouts in the speed cam -- one controls the two retard levers, and the other controls the TIME-BULB LEVER. The Ilex Acme time-bulb lever is a single assembly, much like that found in the Ilex Universal shutter, which provides both "time" and "bulb" actions -- the two settings differ only by the amount of movement permitted the time-bulb lever.

The scribe lines by the time-bulb lever control slot, Fig. 117 indicate the various shutter speeds. Set the shutter to any desired speed by aligning the appropriate scribe line with the nameplate screw hole near the outer release lever.

At instantaneous speeds, the speed cam holds the time-bulb lever control stud away from the lens barrel. The shutter speed then depends on the positions of the two retard levers riding along the edge of the other speed cam slot, Fig. 117. One control stud bears on the outside of the slot -- this control stud is on the INTERMEDIATE RETARD LEVER. The intermediate retard lever

governs the first retard gear train containing the large star wheel and pallet for intermediate speeds. As the control stud moves away from the lens barrel, the intermediate escapement yields a greater amount of retard.

The other retard lever control stud rides on the side of the speed cam opening near the lens barrel -- this is the SLOW-SPEED RETARD LEVER control stud. The slow-speed retard lever operates the slow-speed escapement, the second retard mechanism containing the small star wheel and pallet for slow speeds. The amount of retard is increased as the slow-speed retard lever control stud moves closer to the lens barrel.

Set and release the shutter several times at the 1-second setting. Notice that both retard lever control studs move their maximum amounts during the exposure.

Now, rotate the speed cam in a clockwise direction one speed (one scribe line) at a time, setting and releasing the shutter repeatedly at each setting. You'll find that the slow-speed retard lever is restricted more and more -- until at the 1/25 second setting, Fig. 118, it doesn't move at all. But at 1/25 second, the intermediate retard lever still has full travel.

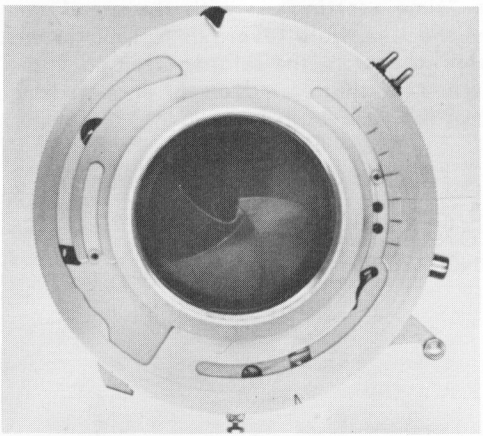


FIGURE 118 SHUTTER SET TO 1/25 SECOND

It's interesting to note that the portions of the Acme speed cam which control the slow-speed retard lever consist of smooth, curved cam surfaces. Consequently, you can make speed settings between the calibration marks and still obtain reasonably accurate exposures. Yet the portion of the speed cam which controls the intermediate retard lever

consists of a series of steps for the different speeds -- thus, the setting must be made with the speed cam accurately placed on the calibration mark for speeds from 1/25 second through 1/50 second.

In general, the step-type speed cam is easier to calibrate. The reason is that each step represents a single speed. A speed cam containing gradual curves to control the retard lever must be calibrated much more carefully at each calibration -- and blended from one setting to the next so that approximations of intermediate speeds are obtainable.

Moving the Ilex Acme speed cam past 1/25 second gradually restricts the movement of the intermediate retard lever -- until, at the highest speed setting, there is no retard whatsoever. But there is no provision for engaging a high-speed spring at the 1/150 second setting.

Turn the speed cam one position past the highest instantaneous speed to the "bulb" setting. Now, the speed cam permits the time-bulb lever to move slightly toward the lens barrel -- while again permitting full travel of the intermediate retard lever.

On the "time" setting -- with the speed cam turned fully clockwise -- the time-bulb lever has full movement. As in many shutters of similar design, the retard action on "time" and "bulb" slows down the shutter movement enough to guarantee full engagement of the time-bulb lever.

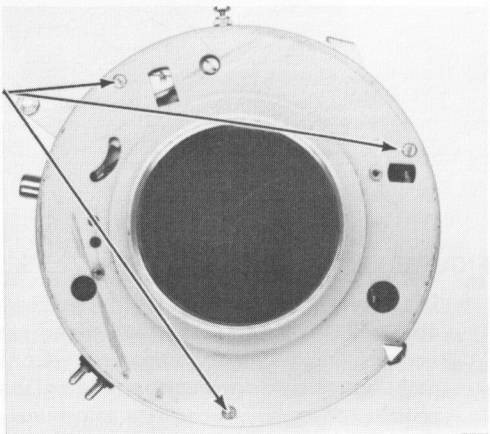


FIGURE 119

Let's now remove the speed cam and the shutter cover plate to examine the tandem action of the two escapements. Rotate the speed cam gently while carefully lifting it from the shutter. You can then see the three screws holding the shutter cover plate Fig. 119. Note the positions of the holes and slots in the shutter cover plate which clear the time-bulb lever control stud and the retard control studs -- then, remove the screws and lift off the shutter cover plate.

Since we've removed the speed cam, the shutter delivers "time" operation. Cock and release the shutter several times to examine the various shutter actions.

Notice that the setting lever Fig. 120 is part of the main lever. But unlike most of the shutters you've studied the main lever has no direct connection with the leaf lever. Instead the main lever gears to the MASTER PINION Fig. 120.

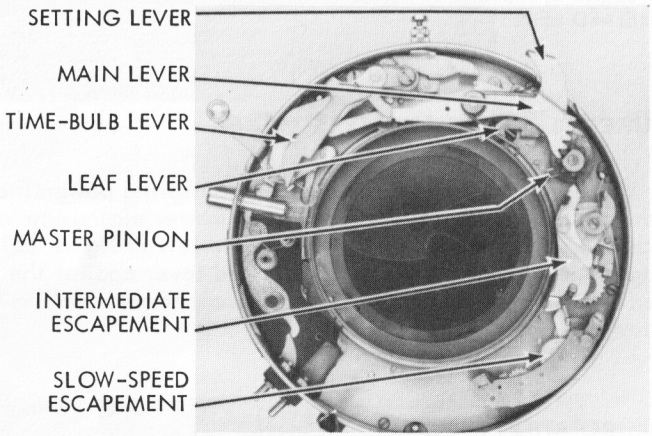


FIGURE 120 SHUTTER RELEASED

The master pinion functions almost exactly like the main lever in the Gauthier (Prontor and Vario) shutters you've studied. The leaf lever, visible beneath the main lever in figure 120, is part of the master pinion assembly. Note in figure 120 that the leaf lever engages a stud on the blade operating ring.

One spring -- the BLADE RING SPRING -- engages the blade operating ring stud to keep the blades closed during the cocking cycle. And another spring -- the LEAF LEVER SPRING -- keeps the end of the leaf lever pressed toward the lens barrel, insuring that the leaf lever engages the blade operating ring stud.

As you cock the shutter, the main lever turns the master pinion counterclockwise. The CAM LOBE on the master pinion, Fig. 121, then moves aside and past the pivoted SWING LEVER on the intermediate escapement.

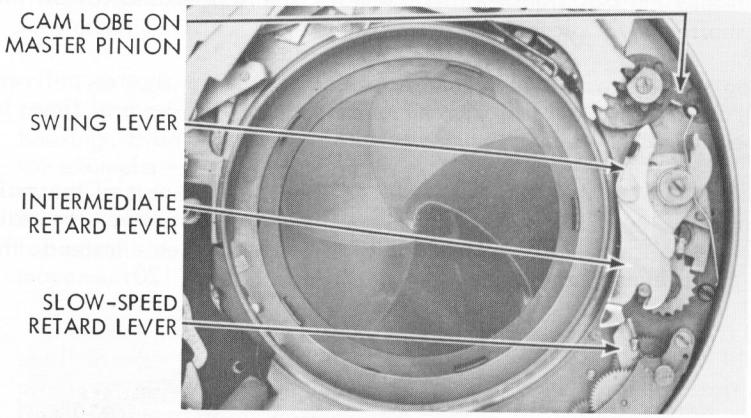


FIGURE 121 SHUTTER COCKED

When you release the shutter, the mainspring powers the main lever through its operating cycle -- the master pinion now rotates clockwise, driving the swing lever to the left in figure 121. The swing lever pushes the intermediate retard lever against the slow-speed retard lever, Fig. 122 -- so both escapements combine forces to slow down the master pinion's rotation.

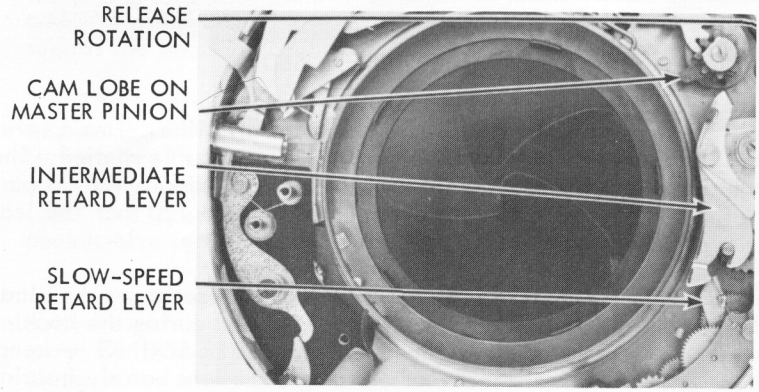


FIGURE 122 SHUTTER RELEASED

We mentioned earlier that the shutter delivers "time" operation with the speed cam removed. That is, the time-bulb lever intercepts the main lever, arresting the movement when the blades are wide open. On "time," you must actuate the outer release lever twice to close the blades.

To remove the time-bulb lever, first disengage the ends of the time-bulb lever spring. Then, take out the screw holding the time-bulb lever in place --but do not remove the spring from the screw.

Removing the time-bulb lever exposes the inner release lever. The inner release lever engages the main lever, Fig. 123, to hold the shutter in the cocked position. Depressing the outer release lever then disengages the inner release lever to free the main lever.

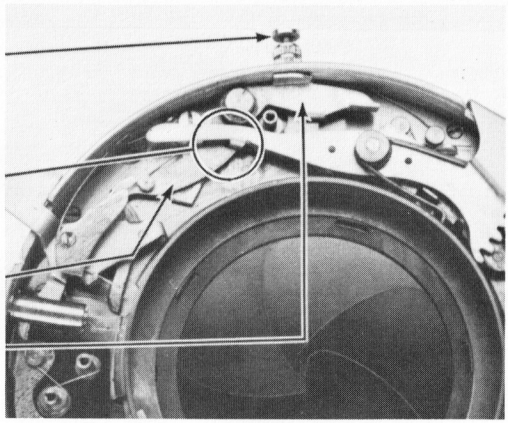


FIGURE 123 SHUTTER COCKED

You can also see how the press-focus feature works in figure 123. The PRESS-FOCUS LEVER controls the inner release lever when you depress the press-focus button.

To open the blades on press focus, first cock the shutter. Then, depress the press-focus button -- the press-focus lever disengages the inner release lever to release the shutter. Once the blades reach the full-open position, the press-focus lever

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